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PHARMACOGRAPHIA INDICA.

A

HISTORY

OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN,

MET WITH IN

BRITISH INDIA.

BY

WILLIAM DYMOCK,

BRIGADE SURGEON, BOMBAY ARMY,

PRINCIPAL MEDICAL STOREKEEPER TO GOVERNMENT,

C. J. H. WARDEN,

SURGEON-MAJOR, BENGAL ARMY, PROFESSOR OF CHEMISTRY IN THE CALCUTTA MEDICAL COLLEGE,

AND

DAVID HOOPER,

QUINOLOGIST TO THE GOVERNMENT OF MADRAS, OOTACAMUND.

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viz., proper, rigidum, multifidum, and rotundifolium. *A. palmatum, Don.*, in the Eastern temperate Himalaya from Garhwal to Manipur. The last species is considered by the natives of Sikkim not to be poisonous. (*Dr. G. King.*)

Hindu writers mention no less than eighteen kinds of Bish or poison, of which ten are said to be unfit for medicinal use on account of their extremely poisonous properties, which they exaggerate to such an extent as to say that their touch is fatal; of the eight kinds which may be used, that known as Teliya*

* Teliya applied to drugs means that they have been greased or oiled to preserve them from the action of the air, *e.g.*, Teliya-tankankhár, Borax which has been greased to prevent efflorescence.

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water. (*Rep. Chem. Exam., Bengal, for* 1884.) About the same time that the arrow-heads were being examined, the Chemical Analyser received from Dr. G. Watt a small cane basket, labelled *Mya-mishmi-baibik,* which had been purchased from the Mishmis. The basket contained 130 grms. of what proved to be small aconite roots, which varied in weight from 4·2 grms. to ·5 grms. The species could not be identified. On analysis, the following results were obtained:—

Moisture at 100° C.	18·26	per cent.
Alcoholic extract of anhydrous roots ...	47·94	„
Fatty matter of do. ...	0·955	„
Chloroform extract of do. ...	0·385	„
Crude aconitine	0·887	„
Aconitine by Meyer's reagent	0·777	„

The pounded root when mixed with water formed a sticky mass well adapted for smearing over arrow heads, for which purpose it is stated to be employed. (*Rep. Chem. Exam. for Bengal,* 1885.)

Cases of accidental poisoning by aconite are occasionally met with arising from the use of the drug by ignorant native doctors as a remedy for fever, &c. Homicidal and suicidal cases are occasionally reported, but are not so frequent as one might expect, considering how readily the drug can be obtained, and how well known are its poisonous properties. Chevers, for example, states that during the ten years ending 1869, only thirty-six cases of aconite poisoning came under the notice of the Bengal Chemical Examiner; and Burton Brown records only nineteen cases in the Punjab in the years 1861—73. The Bengal Chemical Examiner states that the average of five years previous to 1881—82 was 2·4 per cent. in the viscera examined in Bengal. In the same province the number of cases of aconite poisoning were in 1881—82, 3·1 per cent. in 225 viscera examined. In 1882—83, 2·0 in 210; in the remaining nine months of 1883 *nil* in 127; in 1884, 1·8 in 217; in 1885, 1·7 in 234; in 1886, 0·37 in 266; and in 1887, 0·42 in 233.

As regards the percentage of aconite detections in articles suspected to be poisons, the following are the Chemical Analyser's figures for Bengal:—

Average of six years ending March 31st 1883 ...	2·82
Nine months of 1883 ...	2·20
1884 ...	2·10
1885 ...	4·50
1886 ...	3·10
1887 ...	1·10

As a cattle poison aconite is rarely used in Bengal. In Madras aconite was only found in cases in Class A, *viz.*, human cases in which it was suspected that poison had been administered, and in which one or more of the following, *viz.*, viscera, vomited matters and stools were forwarded for examination :—

Year.	No. of cases examined.	Aconite detected.
1882	152	4
1883	123	2
1884	85	1
1885	81	1
1886	84	0
1887	76	4

No aconite detections are recorded in Class B, *viz.*, food and other articles suspected to be poisons.

In Bombay two detections of aconite were made in 1879-80, one in human viscera, and the other in food, the total number of examinations made in the same year being 105. In 1884, two detections were made in a total of 83 examinations, one in human viscera and the other in liquor. Dr. Lyon remarks that aconite (like datura) appears to be occasionally used by native liquor dealers for the purpose of conferring additional intoxicating power on alcoholic liquor, sometimes with fatal results The Bombay Analyser's reports for ten years ending 1884 show only six cases of aconite poisoning, three of which were accidental.

In the Punjab Dr. Center reports that aconite is not often used as a poison. The returns show the following percentages: 1879, 1·8 detections in 162 examinations; 1880, 0·5 in 194; 1881, *nil* in 186; 1882, 1·9 in 201; 1883, *nil* in 194; 1884, *nil* in 200; 1885, *nil* in 234; 1886, 0·35 in 272; 1887, *nil* in 228.

In the North-West Provinces and Oudh four detections of aconite were made in a total of 156 examinations in 1879, and in 1882 three in a total of 156. In the other years, from 1879 to 1887, no detections were made. These figures cannot be compared with those from other Provinces, as no distinction is made between human viscera examined and substances suspected to be poisonous. The aconite root usually sold in the plains of India is ill-suited for homicidal purposes on account of its strong hyraceum-like odour and dark colour. It is probable that in Eastern Bengal aconite root in its natural condition is more easily obtainable than in other parts of the country. The strong smelling aconite appears to be used chiefly for poisoning tigers and other beasts of prey. Aconite has been detected in cattle poisoning, but its use is extremely rare.

Commerce.—Aconite root (Bachnág) is imported into Calcutta and other Indian markets chiefly from Nipal; the black strong smelling kind is almost exclusively used in this country. Its average price is 9—10 annas a pound. Other Vernacular names for it are Mithabish, Sringibish, and Dagra.

White Bachnág can be obtained for the same price from Calcutta. It appears to have been brought into commerce for export to Europe.

In the Southern Concan *Lagenandra toxicaria* is known as Vatsanábh.

Some parcels of Aconite root met with in the Indian markets are composed of much smaller tubers than those usually seen, and are evidently obtained from a different plant than *A.*

ferox, probably from *A. Napellus**; they have the usual strong hyraceum odour. In Madras it is sometimes mixed with the roots of *Gloriosa superba.*

ACONITUM LYCOCTONUM, *Linn.*

Fig.—*Jacq. Aust.* 4. t. 380. *Royle Ill.* 56. *A. læve.*

Hab.—West temperate Himalaya; Kumaon to Kashmir, Europe, N. Asia. The tubers.

Vernacular.—Khánik-et-zeib. (*Arab.*), Bikh (*Hind.*)

History, Uses, &c.—An Aconite called τὸ λυκοκτονον is mentioned by Galen. λυκοκτονος, or the wolf-slayer, was a name given to Apollo, the God who averts evil. Aconite was used by the ancients to destroy wild beasts. Amongst the latter Greeks, Apollo was the Sun-God; for these reasons, possibly, the yellow aconite has been named Lycoctonon.

In 1865, Hübschmann announced that he had discovered in the root and rhizome of *Aconitum Lycoctonum* two new alkaloids, which he named lycoctonine and acolyctine; they differed from one another notably in their solubility in ether and water, lycoctonine being soluble in ether but only sparingly in water, whilst acolyctine was insoluble in ether, but dissolved by water. Hübschmann, however, subsequently stated that acolyctine was probably identical with the napelline he had obtained from *A. Napellus*. Lycoctonine has been examined chemically by Flückiger and by Dragendorff, whilst physiological experiments by Klebs showed that it was much less powerful in its action than aconitine. Schroff, jun., found that different samples of napelline (acolyctine) of commerce varied both in their chemical

* The Aconite of the Greeks and Romans, the ἀκόνιτον ἑτέρον of Dioscorides is generally considered to be *A. Napellus*; Khanik-el-zeib and Khánik-el-nemir (wolf strangle, and panther strangle) are Arabic names for poisonous Aconites. Ibn Sina says in the Kanun that they kill wild pigs, dogs, tigers and panthers, and are not used medicinally. (*Conf. Dioscorides* iv. 76; *Plin.* 27, 2; *Theophr. H. P. IX.*, 16, 17.

reactions and in the degree of physiological effect they were capable of producing; lycoctonine was less active. He also pointed out the fact that the presence of these two alkaloids was an insufficient explanation of the powerful toxic action which the root of *A. Lycoctonum* possessed, and thus threw a doubt on their being the only active principles contained in it. In all these physiological experiments, as well as others by Schroff, sen., Buchheim, Eisenmenger, and Ott, the identity of napelline with acolyctine has been assumed: no trial was made with acolyctine prepared from *A. Lycoctonum*. To throw more light upon these matters (*see also Chemistry of A. ferox*), Messrs. Dragendorff and Spohn (*Pharm. Zeitsch. für Russland* xxxiii., 313—384), investigated the roots of *A. Lycoctonum* collected in Switzerland in July 1883.

Isolation of the alkaloids.—The method adopted by the authors was Duquesnel's modified as follows:—

Two kilos of the powdered root were mixed with tartaric acid (successive portions of 10 and 5 grains) and exhausted with strong spirit; for this, three macerations sufficed. The tincture was concentrated, mixed with water, filtered, and repeatedly agitated with ether whilst still acid. The ether removed traces of an acid resembling protocatechuic, but benzoic acid could not be detected. None of the acid decomposition-products of the alkaloids presently to be described could be found, a proof that a suitable method of extraction had been adopted.

The liquid, after exhaustion by ether, was made alkaline with bicarbonate of soda, and again agitated with ether, which now removed a quantity of alkaloid. After exhaustion with ether, chloroform extracted a further portion of alkaloid from the alkaline liquid, in which, after this treatment, only traces of alkaloid could be detected.

The ethereal solutions were evaporated to dryness and the alkaloid, in which Hübschmann's lycoctonine was anticipated, was purified by powdering, digesting with ether, evaporating the ethereal solution, and repeating the treatment until the

alkaloid dissolved easily and completely in the ether. It was finally obtained in the form of a pale yellow resinous mass, yielding a white powder and dissolving completely in dilute acids. No attempt to crystallize it was successful.

The alkaloid dissolved by chloroform was purified by similar treatment with ether, which solvent removed a notable quantity of the first alkaloid. After purification by solution and treatment with animal charcoal, the second alkaloid was obtained in the form of a white or pale reddish powder. Fifteen kilos of the dry root yielded 170 grams. (1·13 per cent.) of alkaloid soluble in ether, and 120 grams. (0·8 per cent.) of alkaloid soluble in chloroform.

Alkaloid soluble in ether.—In this lycoctonine was anticipated, but it was found on examination to differ materially from that alkaloid, especially in being non-crystallizable. As it could not be identified with any known alkaloid, the name of lycaconitine was proposed for it.

Ultimate analysis showed the probable formula to be $C^{27}H^{34}N^{2}O^{6}+2H^{2}O$, the two molecules of water being given off at a temperature of 110° C., at which, however, the alkaloid itself undergoes change. The accuracy of the formula was confirmed by the examination of the salts as well as of the platinum and gold compounds. The latter, and, indeed, the double salts generally, are unstable, suffering partial decomposition when washed with water.

None of the salts could be crystallized, but as they are easily diffusible, they are probably crystallizable.

A ten per cent. solution of lycaconitine in absolute alcohol is dextro-rotatory $(\alpha)_D = +31·5°$. After drying in vacuo, lycaconitine begins to melt at 111·7°, and is completely fused at 114·8° (corr.); the alkaloid undergoes, as previously observed, partial decomposition.

The reactions of lycaconitine show but little that is characteristic. With sulphuric acid it gives a reddish-brown solution; sulphoselenic acid is coloured rose or pale reddish-

violet; this reaction is not exhibited by aconitine, nepaline, or commercial lycoctonine. Syrupy phosphoric acid yields, with lycaconitine, a violet solution when warmed. Lycaconitine is incompletely precipitated by caustic potash, ammonia, and alkaline carbonates; strong alkalies partially decompose it.

The foregoing details suffice to show that lycaconitine is not identical with Hübschmann's lycoctonine or acolyctine, nor with aconitine or nepaline, or indeed with any known alkaloid.

Alkaloid sparingly soluble in ether.—This alkaloid, extracted with chloroform, after the separation of the lycaconitine by ether, differs so strikingly from Hübschmann's acolyctine that the possibility of identity appears to be excluded. It was named myoctonine, in reference to a species of aconite, myoctonon, mentioned by Pliny. It is amorphous, and the salts it forms could not be crystallized. Analysis showed the formula of the alkaloid after drying over sulphuric acid to be $C^{27} H^{30} N^2 O^8$, and the correctness of this formula was confirmed by an examination of the salts. Bisulphide of carbon, absolute alcohol, benzol, and chloroform dissolve the alkaloid in almost any proportion. The taste is bitter, not pungent. It is dextro-rotatory, melts at 143° to 144°, and gives a precipitate with alkaloid group-reagents, but yields no characteristic colour reactions.

Warmed with 4 per cent. solution of caustic soda, myoctonine decomposes, like lycaconitine, into lycoctonine, lycoctonic acid, an alkaloid resembling acolyctine, and a fourth body the nature of which could not be ascertained. From this it is evident that the long-continued heating with carbonate of soda, to which Hübschmann subjected the alkaloids originally present in the root, converted them into lycoctonine and lycoctonic acid; one or other of these then probably yields acolyctine by further decomposition. Physiological experiments with lycaconitine and myoctonine conducted by M. Salmonowitz showed the latter to be a powerful poison resembling curare in its action, and acting most energetically when introduced directly into the circulation. The sub-

cutaneous injection of 0·075 gram. of nitrate into a cat produced distinct toxic symptoms, and the injection of 0·1 gram. was always followed by death in twenty to thirty minutes. Mice were killed by one milligram in three minutes. Lycoctonine and lycaconine, the decomposition-products of lycaconitine and myoctonine respectively, were found to resemble the original alkaloids in their physiological action, but to be less powerful. (*Year-Book of Pharm.*, 1885.)

ACONITUM HETEROPHYLLUM, *Wall.*

Fig.—*Bentl. and Trim., t.* 7.

Hab.—West temperate Himalaya from Kumaon to Hansora. The tubers.

Vernacular.—Atís (*Hind.*), Ativish (*Mar.*), Ati-vadayam (*Tam.*), Ati-vasa (*Tel.*), Atavakha-ni-Kali (*Guz.*).

History, Uses, &c.—The earliest notices of Ativisha* are to be found in Hindu works on Materia Medica, Sárangadhara and Chakradatta, where it is recommended as a remedy in fevers, diarrhœa, dyspepsia and cough, also as an alexipharmic; those in Arabic and Persian works are short, and apparently copied from them; they direct it to be prescribed in combination with aromatics, astringents and sometimes with other bitters, such as Bonduc-nuts, Tinospora, Holarrhena, &c. It is an ingredient in *Bál-goli*, a pill given to infants to keep them quiet, which contains thirty-one drugs, of which *three are narcotics, viz.,* Bhang, Opium and Datura, and the remainder bitters and aromatics. This pill is sold by all the native druggists, and, it need hardly be said, is most fatal to children. The author of the Makhzan-el-Adwiya calls Atis an Indian root, resembling a small specimen of *Aristolochia longa*, and says that some authorities describe three kinds, *viz.*, Atís, Part-bikhta, and Shámkand; but others only two kinds—white and black. He says it is aphrodisiacal and tonic, checks

* Ati-visha, counteracting poison.

diarrhœa, and removes corrupt bile and cold humours and the diseases arising from them.

The early English physicians in India appear to have been chiefly impressed with its antiperiodic and tonic action in fevers, and the drug has until quite a recent date been much administered as an antiperiodic in doses of about 30 grains every four or six hours. The discovery that the active principle, Atisine, is only present in very small quantities in Atís, seems to have brought the drug into discredit, and the European demand for it has much fallen off. The evidence collected by Dr. G. Watt for his Dictionary of the Economic Products of India indicates that Atís is now considered an indifferent antiperiodic by medical men. Dr. M. Sheriff considers that the ordinary doses are only useful as a tonic, and that two drams or more should be given as an antiperiodic. Probably the native estimate of the drug, as given above from the Makhzan, is not far from the truth, *viz.*, that it is tonic and digestive and often useful in dyspepsia with diarrhœa.

Description.—The drug, as sent into commerce, may be divided into two portions, grey and white; the grey shrivelled tubers, which are larger and longer than the white, are the mother roots, and are often separated and sold at a lower price. The young daughter-tubers should be quite plump, externally of a pale ash colour, slightly scarred from the abrasion of rootlets, from ¾ to 2 inches long, obconical, or almost ovoid, with a thin tap-like extremity, which is sometimes double, or has a tendency to divide; at the summit there is a scaly leaf-bud. Atís should break with a short starchy fracture, presenting a white surface, near the circumference of which several vascular bundles are observable with the naked eye; it should taste purely bitter, and have no particular odour.

Microscopic structure.—The tubers consist of a delicate cellular parenchyme filled with starch, in which are to be observed about four vascular bundles, which, in the young tuber, are near the centre, but subsequently are removed towards the circumference. The epidermis consists of light

brown tabular cells; the brown zone seen in Aconite is not present.

Chemical composition.—The authors of the Pharmacographia, upon the authority of Broughton, state that the root contains a well-defined alkaloid of intensely bitter taste, Formula $C^{46} H^{74} N^{2} O^{5}$ obtained from concurrent analyses of a platinum salt. Wright (1878) percolated the powdered dry root with alcohol containing a little tartaric acid, and evaporating the percolate he obtained ultimately Broughton's alkaloid *atisine*. This was uncrystallizable, but with hydrochloric acid and gold chloride, he obtained a crystalline hydrodichloride, $C^{22} H^{31} NO^{2} HCl, AuCl^{3}$, from which he suggests that $C^{22} H^{31} NO^{2}$ may prove nearer the correct formula for atisine than that given by Broughton. Atís has recently (1879) been examined chemically by Wasowicz. The general results of his investigation are: that he found the root to contain—(1) a fat of soft consistence, probably a mixture of oleic, palmitic, and stearic glycerides; (2) aconitic acid; (3) an acid related to ordinary tannic acid; (4) cane-sugar; (5) vegetable mucilage; (6) pectous substances; (7) atisine, the alkaloid already observed by Broughton, and probably another uncrystallizable alkaloid; (8) starch. The root contained 2·331 per cent. of ash that dissolved partly in water and partially in dilute hydrochloric acid. Experiments made in administering the alkaloid to rabbits show that it is not poisonous. The quantity in the root is exceedingly small ($\frac{6}{100}$ of 1 per cent.). The purified alkaloid is white and uncrystallizable; of its salts, only the hydrochlorate, hydrobromate and hydriodate are crystallizable. (*Archiv. der Pharmacie,* Vol. XI., p. 19.) Atisine when dissolved in sulphuric acid gives a purple colour, a reaction which has been observed by E. Z. Gross with coptine obtained from *Coptis trifoliata*; and with hydrastine, one of the alkaloids of *Hydrastis canadensis,* plants belonging to the same natural order.

Commerce.—Atís comes into the plains through the principal towns of Northern India; it would appear that in some parts

of Southern India other roots are sold as Atís. (*Pharmacographia*, p. 15.*) The average price is Rupee ¾ to 1 per lb.

ACONITUM PALMATUM, *Don.*

Hab.—Temperate Himalaya from Sikkim to Garhwal, Mishmi. The tubers.

Vernacular.—Bikhma, Bishma (*Hind.*), Wakhma or Vakhma (*Bomb.*).

History, Uses, &c.—It is impossible to trace the history of this drug in Indian and Persian works on Materia Medica, though doubtless it is one of their non-poisonous kinds of Bish. The author of the Makhzan-el-Adwiya notices it as a non-poisonous kind of Bish, and says it may be prescribed in the same manner as Atís. In English works upon Indian drugs, it appears to have almost escaped attention. Dr. Buchanan, in his account of the Kingdom of Nepal, enumerates four kinds of Bikh, of which Bikhma is one; he describes it as a powerful bitter: it is a rare drug in most parts of the country. Bikhma is intensely bitter, like quinine, and is administered by Native doctors in combination with black pepper, or mace, in doses of about eight grains, as a remedy for pains in the bowels, diarrhœa, and vomiting; also to destroy intestinal worms and to remove costiveness. Externally it is applied in rheumatism. From its sensible properties we may conclude that it would be likely to prove a valuable tonic and digestive; but unless it is much more powerful than Atís, its high price and rarity will prevent its general use.

Description.—Tuberous roots of a light brown colour, 2 to 4 inches long, much resembling some samples of horny and farinaceous Bish in structure, *but differing from them in being*

* The rhizome of *Cryptocoryne spiralis*, which has lately attracted attention by being offered for sale in London as a kind of Ipecacuanha, is the root referred to; it is known in Madras as Náttu-ati-vadayam or country-atís. (*Lawson.*)

branched. The tubers break with a short fracture, and the inner substance is either white and farinaceous, or horny and yellowish; both kinds of tuber have a pure persistent bitter taste and no acridity; the horny tubers when moistened develop a pungent smell like nasturtium.

Microscopic structure.—The tuber is composed of a starchy parenchyme, with from 6—12 bundles of scalariform vessels; in young roots these are crowded together towards the centre, but in more mature ones they are nearer the circumference; there is no brown zone connecting the vascular bundles.

Chemical composition.—Bikhma has been examined in Prof. Flückiger's laboratory by Mr. Yüuichiro Shimoyama, who reports as follows:—"Ten parts of the powdered tubers with one part of slaked lime and about 100 parts of water were dried. The dried powder was repeatedly extracted by a sufficient quantity of strong alcohol, and the latter removed by distillation, to the residue a little acetic acid and water was added to get rid of resinous matters. The filtrate was further purified by means of ether, and the alkaloid precipitated from the acetic solution by adding caustic lye. By repeating the same treatment the alkaloid was at last obtained as a perfectly white amorphous powder of decidedly alkaline reaction, and a very persistent purely bitter taste. The alkaloid dissolved in excess of hydrochloric acid, yielded needle-shaped crystals of the hydrochlorate, which were not produced when a neutral solution was used. The hydriodate was also found to be crystallizable, but not the picrate, chromate, or iodohydrargyrate. The aqueous solutions of the alkaloid were precipitated by bichloride of mercury and by tannic acid, not by iodide of potassium. The alkaloid was found to be readily soluble in alcohol, chloroform, bisulphide of carbon, benzol and ether, but none of these solutions afforded crystals; it was dissolved by concentrated sulphuric acid, and the yellowish solution gradually assumed a splendid purple colour, lasting for a day or more; it turned violet on addition of a few drops of water. If the alkaloid is evaporated at 100° C. with phosphoric acid, a fine violet hue is also produced."

Prof. Flückiger remarks:—"The alkaloid which Wasowicz extracted from *A. heterophyllum* in my laboratory is the same as that yielded by the Wakhma tubers."

Commerce—Bikhma is brought in small parcels to the Indian cities by religious mendicants. Value Rs. 2 to Rs. 6 per lb. according to the quantity in the market.

JADWAR.

The great purifier, or antidote. Arabic form of the Persian Zadwár زدوار quasi زدای وار In Ætius the Greek form is ζέδοαρ and Myrepsus writes τζετὸυαριον. The Persian plant is also called Mah-parwin (Moon and Pleiades), probably because it blossoms in the beginning of summer when the Pleiades rise. Macer calls it Zedoar,—

> "Adprimè sumptis zedoar obstare venenis
> Affirmant."

History, Uses, &c.—The history of this drug is beset with many difficulties, on account of the vague meaning of the term Jadwár; the name by which it is generally known, and which appears properly to mean the great antidote. Under Jadwár, the author of the Makhzan-el-Adwiya gives Antila as the Arabic name, and Sáturyús* as the Greek. Speaking of Bísh he says that the Hindus suppose that the only plant which can grow near it is the Jadwár, which is an antidote to it, and that they also affirm that there is a kind of rat, called 'Bish mush bisha,' which lives upon Jadwár, and is an antidote to Bish; this is the Búka Bish Mush of Ibn Sina.

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* Dioscorides describes two kinds of σατύριον (III. 134-135), both reputed to be aphrodisiacal; see also Pliny on Satyrion (26, 62, 63). Apuleius Platonicus says of Satyrion: Alii cinos, alii panion, Galli via, a Græcis satyrion, alii ennaticon, alli serpinon, Itali priapiscum, Ægyptus orcisalitexion, alii eriton, alii mene, alii torminalis. Neophytus speaks of ἀντουρα as an antidote; speaking of Zedoar he says ἔοικε δὲ ξηρῳ καὶ μέλανι μικρῳ καστάνῳ. (It is like a small, dry, black chestnut.) Barbosa mentions Zedoaria and Zeruban as two distinct drugs on sale at Cannanore. (*Cf. Salmasius de Homon. sub voce Gedwar.*)

The Indian name Nirbishi he explains incorrectly as Nir, the antidote to Bish, the poison*; he describes five kinds :—

"*1st*—Khatai, black externally, purplish brown internally, scorpioid, knotted, tasting sweetish at first, afterwards very bitter.

2nd—Outside and inside brown, or yellowish brown.

3rd—Outside and inside black; when rubbed down it has a purplish tinge, bitter. This and the second kind come from Thibet, Nipál, Morang and Rangpore. (These three kinds are probably the roots of some kind of Aconite or Delphinium.)

4th—Blackish, bitter, size of an olive, comes from the Deccan hills, probably the tuber of a Curcuma. (The Gedwar figured in Clusius' Exotica, p. 378, appears to be of this kind.)

5th—Spanish, called Antila, black, soft, very bitter (ἀντουρα probably *Aconitum Anthora*)."

Of these, the first kind is said to be most esteemed. It would appear, then, that the term Jadwár has at different times been applied to various tuberous roots supposed to have alexipharmic properties, and that in India it is now applied to the root of a Delphinium or Aconite, at present known to the Hindus as Nirbishi, a term which, like Jadwár, has at different times been applied to very different plants. Royle tells us that the best Nirbisi is brought down from Bissehar and Amritsar, and is fusiform, and resembles Bikh; when cut it is of a brownish colour and slightly bitter and acrid. Aitchison says that *Jadwar-i-Khatai* is the name in Leh for the root of an Aconite imported from Nipal *via* Lhassa. It is called in the Punjaub *Nirbisi*, by Bhoteas in Leh *Bonga*, and by the Yarkandis *Farfi*; it is poisonous, and is administered in cases of poisoning and in severe illness, such as cholera, and is carried as a talisman about the person. Ulasr Muharrir says

* Nirvisha is a Sanskrit adjective meaning "not poisonous," and nirvishâ or nirvishi is never applied to aconite by medical writers, but denotes a peculiar grass, used as an antidote to certain poisons, namely, *Kyllingia monocephala, Linn.*—(*Dr. Rice.*)

that false Jadwár is prepared by boiling the roots of some of the milder kinds of Bish in milk, and colouring them; it is to be distinguished from genuine by its parting with its colour when dipped in warm water and wiped with a cloth; it has also a shrivelled appearance, and the central portion to which the colour has not penetrated is pale; instead of being intensely bitter, it is slightly acrid.

Native medical works abound in absurd stories concerning this article, and its wonderful power as a tonic and alexipharmic; it fetches a high price, and is generally kept in metallic mercury to prevent its being injured by insects; sometimes it is preserved in oil.

Jadwar appears to resemble much the Tienhiung of the Chinese, which is said by Dr. Porter Smith to be derived from *Aconitum variegatum.* Like Jadwár, this drug is blackish-brown internally, and more or less moist, having evidently undergone some kind of preparation. Dr. Morrison, Medical Officer to H. M.'s Consul at Newchwang in Manchuria, mentions in a recent Consular report that Manchuria exported in 1884, 13,866 lbs. of the roots of *Aconitum Anthora, barbatum,* and *Fischeri* (?) for use in medicine on account of their stimulant, diuretic and alterative properties.

Description.—What is considered now to be genuine Jadwár in India consists of small blackish-brown tubers, some irregularly ovoid, some conical, seldom more than one inch long and half an inch in diameter; they are somewhat wrinkled, and bear a few horn-like projections, which are the remains of rootlets; at the crown there is a scaly leaf bud. When in good condition the tubers are softish, and cut like a piece of dry liquorice extract, the colour being a uniform dark brown throughout; to the naked eye the cut surface appears structureless, and might be mistaken for an extract; it has a somewhat fruity smell and bitter taste.

Microscopic structure.—A transverse section shows a dark brown epidermis, composed of compressed cells, an outer ring of parenchyme, the cells of which contain starch granules and

much brown granular matter; within this are from 5 to 10 vascular bundles, connected together by a cambial zone, made up of several rows of small, dark brown cells; the position of the bundles is very irregular, consequently the zone has a peculiar waving course. In the central portion of the tuber starchy parenchyme is again met with; the starch has not been altered by heat.

Chemical composition.—Twelve ounces of the roots treated by Dragendorff's process for aconitine, yielded no trace of alkaloid upon evaporation of the benzine solution. The treatment of the drug by acidulated water extracted a large quantity of black extractive which was almost entirely soluble in alcohol. It seems probable that the roots undergo some form of preparation during which they are charged with foreign extractive matters, and probably rendered almost inert as a medicine.

Commerce.—Jadwar is brought for sale to the Indian cities in small parcels by religious mendicants.

DELPHINIUM ZALIL, *Aitch. et Hemsley.*

Fig.—*Trans. Linn. Soc. Ser.* 2. *Bot. Vol.* iii., *Pl.* 3.

Hab.—The Badghis and Khorasan. The herb.

Vernacular.—Zarir (*Arab.*), Zalil, Aşfrak, Asperag (*Pers.*), Tráyamán, Gul-jalil (*Bomb.*), Gáfiz, (*Punj.*).

History, Uses, &c.—In Hindu medical works a drug called Tráyamána is frequently mentioned as a remedy for enlargement of the abdominal viscera; it appears to have been well-known, as it has numerous synonyms such as Baládeva, Balábhadra, Mangalya, Mángalyarha, and Arjaka, signifying that it was considered to be very auspicious.* The same name is still current in Northern India and Guzerat to indicate the drug imported from Persia under the name of Zalil, and

* Yellow is a most auspicious colour amongst the Hindus, the garments of the bride are dyed of this colour. The word Trayamana still exists in the Persian language, with the meaning of "yellow" and "diarrhœa."

described in Mahometan works on Materia Medica as Zarir. In Bengal and Southern India the drug is unknown, and *Ficus heterophylla, Linn. fil,* is used as a substitute for it under the names of Balábahula and Valli-teragam. The author of the Makhzan-el-Adwiya says :—" Zarir grows in the Khorján hills and is called Asfrak by the people of Shiráz, and Arjikan by the Greeks*; the stem is about a span high, flowers yellow, like those of Asfar-i-barri, surrounded by a few soft prickles, leaves yellowish, small, root more than a span long. Asfrak is cold and dry with slight heating properties; also detergent, anodyne and diuretic; it is useful in spleen, jaundice and dropsy; mixed with barley meal, it forms a poultice, which is of much service in inflammatory swellings; its ashes are useful in itch. Maximum dose 5 dirhems †; it is also used as a yellow dye." In India and Persia it is now chiefly used for dyeing silk. Edgeworth brought this drug to notice many years ago, and supposed it to be derived from *D. altissimum.* The true plant has been discovered by Aitcheson in the moister localities of the Badghis and Khorasan at an altitude of 3,000 feet. He says that when in flower it gives a wondrous golden hue to the pastures. (One of the Sanskrit synonyms is Sita or moonlight.).

Description.—The drug consists of the flowers, leaves, flower stalks, and a small proportion of the immature fruit, all of a light greenish yellow colour, and having a somewhat honey-like smell; the flowers are pubescent; many of them tolerably perfect, resembling in size and shape those of the common single Larkspur; the fruit consists of three follicles, which are arranged like those of the aconite and dehisce on the inside; they are marked with prominent longitudinal ribs, have pointed apices, and are supported upon a stout curved peduncle; the seeds are numerous, angular, and of a light-brown colour. The drug when placed in water immediately tinges it a bright yellow, and communicates a bitter taste to it.

* Arjikan is apparently the Sanskrit word अर्जिक.

† Five dirhems—240 grains in 24 hours in decoction. A reference to the chemical composition will show that this dose may possibly prove dangerous.

Microscopic structure.—The seeds are thickly set with white feather-shaped hairs, arranged in rows.

Chemical composition.—The drug reduced to powder lost 23·5 per cent. of moisture when heated to 100° C. The ash amounted to 17·8 per cent. Treated with 94 per cent. alcohol 13·4 per cent. of a dark reddish, bitter, acid extract was obtained. The extract was mixed with water acidulated with hydrochloric acid, and repeatedly agitated with ether. During agitation, blackish resinous matter separated, while the ether became turbid from the separation of a white principle.

On filtration of the aqueous solution 2·6 per cent. of a dark resinous body was obtained, which was soluble in ammonia to the extent of 2·54 per cent. The ammoniacal solution was of a dark brown colour, the addition of acids caused the precipitation of dirty yellowish flocks; this principle had the properties of an acid resin. The residue insoluble in ammonia amounted to ·06 per cent., and was white; it was not further examined.

The ethereal solution after filtration yielded 1·63 per cent. of extractive, the residue on the filter was white, and had the physical characters of the principle left after the action of ammonia on the black resin already mentioned. The ethereal extract was redissolved in ether, and agitated with ammonia. On separating the ether, it left on evaporation ·69 per cent. of a greenish-yellow oily residue, from which a white crystalline principle slowly separated. This crystalline principle will be referred to again. The ammoniacal solution yielded with acids brownish-yellow flocks, which had the properties of an acid resin; this principle would appear to be similar to the dark resin left as a residue after agitation of the original aqueous solution with ether.

The original aqueous acid solution left after separation of the ether was repeatedly agitated with amylic alcohol. The separated amylic alcohol was agitated with ammonia, which became coloured of a deep yellow hue; on separating the

amylic alcohol, it left on evaporation ·51 per cent. of a neutral, yellow, transparent principle insoluble in alkaline solutions. This principle was not further examined. The deep yellow ammoniacal solution yielded yellow flocks on the addition of acids, which were redissolved on agitation, the resulting solution being of a dirty brown colour; the addition of alkalies again caused the liquid to assume its original deep yellow colour. This principle had the properties of an acid, and will be referred to subsequently. The amylic alcohol extract also afforded evidence of the presence of a tannin, which gave with erric chloride a deep greenish coloured solution.

The original aqueous acid solution was now rendered alkaline by ammonia and agitated with ether. The separated ether had a marked blue fluorescence, on evaporation a slightly yellow transparent varnish-like residue was left, soluble in acids, the resulting solution possessing a bitter taste. Alkalies caused the precipitation of white flocks easily soluble in ether, and precipitates were obtained with all the alkaloidal reagents; no distinctive colour reactions were yielded. The crystalline principle referred to as occurring in the ether extract obtained from the aqueous acid solution of the extract had the same properties as the alkaloid now described, indicating that the principle was separable by ether both from an acid and alkaline solution. The alkaline original aqueous solution was now agitated with amylic alcohol; the separated amylic alcohol left on evaporation a yellow residue, which was partially soluble in acids. After filtration to separate insoluble matter, the clear aqueous solution yielded yellowish flocks with alkalies, insoluble in ether, but dissolved by amylic alcohol. The solution of the principle in acids had a yellow colour and was bitter to taste, and gave a precipitate with the ordinary alkaloidal reagents; some of the colour reactions were similar to those yielded by berberine. Regarding the nature of these two bitter alkaloids, though they afforded reactions with reagents which were not inconsistent with their being delphinine and berberine respectively, but

without data regarding their ultimate composition, it would be premature to definitely designate them.

The yellow acid separated by amylic alcohol is of interest, because to its presence the tinctorial value of the drug as a dye-stuff is doubtless due. In order to obtain the acid in a pure state the following method was tried:—A concentrated aqueous solution of the plant was precipitated with lead acetate, and the yellow precipitate well washed by decantation. The washed precipitate was diffused through water acidulated with hydrochloric acid, and the separated chloride of lead removed by filtration. The yellow solution was agitated with amylic alcohol; on evaporating off the amylic alcohol a deep yellowish red extract was obtained, easily soluble in water, and possessing a marked acid reaction. The addition of acids caused the precipitation of yellow flocks, soluble on agitation; the addition of alkalies caused the liquid to assume a deep yellow colour. The aqueous solution gave a dirty olive-green coloration with ferric chloride, due probably to the presence of a trace of tannin. The aqueous solution agitated with water acidulated with sulphuric acid in a sealed tube at 100° C. for some hours afforded a turbid solution, which contained dark brown flocks, and which precipitated an alkaline solution of copper on boiling.

The principles separated from the drug may be arranged as follows:—

Dark acid resin.
White neutral principle.
Yellow neutral principle.
Colourless bitter alkaloid.
Yellow bitter alkaloid.
Tannin.
Yellow acid.

Commerce.—Trayamán or Gul-jalil is imported into Bombay and Northern India from Persia, and is of some importance as a yellow dye for silk. It is worth about Re. ½ per lb.

NIGELLA SATIVA, *Sibthorp.*

Fig.—*Zorn. Ic.* 119. Small Fennel-flower (*Eng.*), Nielle, Toute épice (*Fr.*).

Hab.—The Mediterranean countries. Cultivated in India.

Vernacular.—Kalajira, Mugrela (*Hind., Beng.*), Kalonji (*Bomb.*), Karun-shiragam (*Tam.*), Karijirigi (*Can.*), Nalla-jilakara (*Tel.*), Kalejiré (*Mar.*), Shuniz, Siyah dánah (*Pers.*).

History, Uses, &c.—According to Birdwood, it is the Black Cummin of the Bible, the Melanthion of Hippocrates and Dioscorides, and the Gith of Pliny.* Ainslie mentions its use as a carminative, also as an external application mixed with sesamum oil in skin eruptions, as a seasoning for food, and as a protection for linen against insects. Forskahl, in his Medicina Kaharina, says that it is a native of Egypt, where it is called Hab-es-souda.† Roxburgh believes it to be a native of Hindostan. Anyhow, it must have been long known in India, as it has a Sanskrit name, Krishnajiraka. Nigella seed is extensively used as a spice, and as a medicine; it is prescribed by the Hindus with other aromatics and plumbago root in dyspepsia. The Hakeems describe it as heating, attenuant, suppurative, detergent and diuretic, and consider that it increases the menstrual flow and the secretion of milk; also that it stimulates uterine action. They give it, too, as a stimulant in a variety of disorders which are ascribed to cold humours, and credit it with anthelmintic properties. It is sprinkled over the surface of the bread made by Mahometan bakers along with Sesamum seed. (*See Cuminum Cyminum.*) M. Canolle has recently published (*De l'avortement criminel*

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* Plin. 19, 52, 20, 71; Cels. 2, 34; Scrib. Comp. 131.

† الحبة السوداء El-habbat-es-souda, i.q., الشونيز El-shooniz, or properly الشينيز El-sheeniz, for thus the Arabs called it according to Ibn-el-Aarabi, or, as some say, i.q., الحبة الخضراء El-habbat-el-khizra, because the Arabs often call black اخضر and green اسود. This seed is said in a tradition to be a remedy for every disease except death. (*Madd-el-Kámus.*)

à Karikal. Thèse de Paris, 1881,) the results of clinical investigations undertaken in the hospital at Karikal with black cummin seed. He has observed that after doses of 10 to 40 grams of the powdered seed the temperature of the body is raised, the pulse accelerated, and all the secretions stimulated, especially those of the kidneys and skin; in doses of 10 to 20 grams. they possess a well marked emmenagogue action in dysmenorrhœa, and in larger doses cause abortion.

Description.—The seed is triangular, the umbilical end being smaller than the other, black, ⅛th of an inch long, testa rough; inside the testa is a white oily kernel. When rubbed, the seed diffuses a pleasant odour of lemons, with a slight *soupçon* of carrot.

Chemical composition.—The seeds of *Nigella sativa* have been analysed by H. G. Greenish (*Phar. Jour.* (3) X., 909 and 1013), with the following results:—One hundred parts of the seeds contain: Moisture 7·43, Ash 4·14, Fixed oil 37·00, Volatile oil 1·64, Albumen (sol. in water) 8·22, Mucilage 1·90, Organic acids ppt. by Cu. 0·38, ditto by Pb. 0·59, Sugar (Glucose) 2·75, Arabic acid (?) 3·21, Undetermined substance 1·79, Albumen (sol. in soda) 2·14, Metarabin 1·36, other substances dissolved by soda 5·38, Melanthin 1·41, Traces of oil, &c., removed by Alcohol 0·53, dissolved by Chlorine water and Sulphuric Acid 3·85, removed by Chlorate of Potash and Nitric Acid 7·52, Cellulose 8·32—total 99·56. *Melanthin* bears a close analogy to helleborin; like saponin, it possesses considerable emulsifying powers. Greenish has also obtained melanthin from all the aerial parts of *N. sativa*, but found it absent in the roots at all periods of their growth.

Commerce.—The Indian market is supplied from Northern India, Basara, and Cabul. Price 2 annas per lb.

PÆONIA OFFICINALIS, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1784. Officinal Peony (*Eng.*), Pivoine officinal (*Fr.*).

Hab.—*Europe.* The tubers.

Vernacular.—Úd-sálap (*Hind.*), Ude-sálam (*Bomb.*). *

History, Uses, &c.—This drug is the female Peony of Dioscorides, and was esteemed by the ancients as a valuable remedy in uterine obstructions, colic, bilious obstructions, dropsy, epilepsy, convulsions and hysteria. Dioscorides describes two kinds of Peony, male, *P. corallina*, and female, *P. officinalis*, † these are the two kinds of Fawánia described by Arabic and Persian writers. Galen describes its acrid qualities and emmenagogue virtues, and its use as an astringent in diarrhœa. According to Pliny, the name Pæonia is derived from Pæon, the physician of the gods, who was the first to discover this plant. Hippocrates mentions the use of the seeds in uterine obstructions. The roots of *P. corallina* are turnip-shaped and about as thick as the thumb; those of *P. officinalis* consist of oblong tubercles attached by a stout fibre to a rhizome. The plant and roots are figured by Guibourt (Vol. III., p. 763). Úd-sálap is used by the natives as a blood-purifier for children. In the time of Galen a superstition prevailed that Peony root enclosed in a bag and hung round a child's neck both prevented epileptic attacks and cured them, and this belief is not extinct among the peasantry of Europe even now; they also believe that wearing the seeds will prevent the dangers of dentition. Macer Floridus (*De Vir. Herb.*) says:

> 'Illius radix, pueris suspensa caducis,
> Non modicum prodest, Galienus ut asserit auctor.'

The plant has been proved not to be inert; it produces headache, noise in the ears, confused vision, colic and vomiting if taken in full doses (60 grs.). Modern observation has neither confirmed nor condemned the ancient opinions concerning it; and although some have reported favourably of it

* Corruptions of عود الصليب (Aod-el-salib) or '*wood of the cross*,' an Arabic name for the root of *P. corallina*, because on section it shows two lines crossing one another, which are not seen in the female Peony.

† Dios. iii. 148; Plin. 25, 10, 27, 60.

in epilepsy, chorea, and whooping cough, the evidence in favour of its efficacy is very slender.

Description.—The dried tubers are from 1 to 3 inches in length, and ½ inch to ¾ inch in diameter, tapering to a point at both ends; the external surface is brown and channelled longitudinally; the interior is starchy and white; the cortex on section is seen to be hard and gritty and of a yellowish colour; taste slightly acrid; the central starchy portion is almost tasteless. The odour of the freshly cut tuber is faintly acrid.

Chemical composition.—Wiggers obtained from the fresh root a distillate having the odour of bitter almonds, and acquiring a blood-red colour by ferric chloride; separated by means of ether the volatile oil had a pale yellow colour; the analysis of the fresh root by Morin proved the presence of starch, sugar, fat, malates, oxalates and phosphates, a little tannin, &c. (Stillé and Maisch, *National Dispensatory*, 3rd Ed., p. 1122.)

Commerce.—The tubers are imported from Turkey.

COPTIS TEETA, *Wall.*

Fig.—*Griff. Ic. iv., t.* 660, *f.* 2.

Hab.—Assam, China, Tibet. The rhizome.

Vernacular.—Mámírán, Mishmí títa (*Hind., Bomb.*), Haladio-vachnag (*Guz.*), Sou-line or Chynlen (*Chin.*).

History, Uses, &c.—The μαμιρὰς of Paulus Ægineta, who doubtless obtained his knowledge of it from the early Indian traders; the drug probably passed by the same commercial route as it does now, viz., from China to Western India, and thence to Europe. Mámírán is noticed by the early Arabian writers as a kind of Turmeric (Urúk). The plant is described by Mir Muhammad Hussain "as having leaves like ivy; it is said to grow near water in the hilly parts of India, China, and Khorasán. The Indian kind is described

as yellow with a brown tinge; the Chinese as yellow; the Khorasán as greenish brown; the seed is said to be like sesamum. The best kind is the Chinese, which should be small, yellow, hard, and knotty; it is said to keep good for twenty years." Whether the three kinds here described are all varieties of Coptis, it is impossible to decide. Indian writers say that Mámírán used as a collyrium clears the sight, and as a snuff the brain, and that it relieves toothache. Internally it is given in jaundice, flatulence, and visceral obstructions. Bernier, who visited Cashmere in the train of the Emperor Aurangzebe, mentions Mámírán as a medicine very good for the eyes, which was brought into that country by caravans from Thibet. It was first described by Wallich in 1836. (*Trans. of Med. and Phys. Soc. of Calcutta,* VIII., 85.) It is worthy of notice that this drug, and extract of Barberry (Rusot), both containing a large quantity of berberine in a soluble condition, are used as collyriums by the natives in certain catarrhal and rheumatic affections of the conjunctiva. (*Cf.* Prof. Simpson in *Phar. Jour.* 1854, Vol. XIII., p. 413.) Lately Coptis root has been chiefly used as a tonic by Europeans in India; it has the advantage of acting gently on the bowels. Extended observation of the action of Coptis root shows, that during recovery from malarial fever and in atonic dyspepsia (the inward fever of the natives) it is a valuable medicine, restoring the appetite and giving tone to the system. It may be administered in infusion (one ounce to a pint of boiling water) or in tincture (one ounce to a pint of rectified spirit) in doses of two drachms of the tincture or two ounces of the infusion; or the two preparations may be combined.

Description.—Two distinct varieties of this drug are met with in the Indian market. The kind most esteemed is a yellowish rhizome, as thick as a crow-quill or larger, having a few spinous projections where rootlets have been broken off; the whole rhizome is jointed, but at the upper end the joints become much more marked, and a stem clasping petiole often remains attached to each. The roots are described by Paulus

as having many knuckle-like joints—μαμιρας οἷον ῥιζίον τι πόας ἔχον ὥσπερ κονδύλους πυκνούς. The second kind is as thick as a goose-quill, and covered with thin wiry rootlets; it often branches at the crown into two or three heads, which terminate in tufts of leaf stalks, crowded together, and not separate as in the first kind; the rhizomes of both kinds are contorted, and have a short fracture, the centre is spongy, and the surrounding portion bright yellow and woody; taste purely bitter. The first kind corresponds with the description of Coptis root in the *Bengal Dispensatory*. The second kind with the description in the Pharmacographia, which appears to refer to *Coptis anemonæfolia*. (*See Pharm. Journ.* (3) X., p. 23.)

Microscopic structure.—The bark of the second kind is much the thickest, and is softer and more corky than that of the first; in both kinds bundles of orange-coloured schlerenchymatous cells are present, and the medullary rays contain starch; the wood is arranged in distinct wedge-shaped bundles, round a central parenchymatous portion, having a structure similar to that of the inner cortex.

Chemical composition.—Coptis root contains 8½ per cent. of berberine so combined as to be easily soluble in water; the nature of this combination has not yet been determined. E. Z. Gross has separated from *Coptis trifoliata, Salisb., coptine*, a colourless alkaloid. Coptine forms with potassio-mercuric iodide a crystalline precipitate which dissolves in Sulphuric Acid to a colourless liquid, becoming purple-red when heated. (*See Atisine.*)

Commerce.—Both kinds of the drug come to Bombay from China, *via* Singapore, in bulk. The first sort is worth Rs. 3¼ per lb.; the second Rs. 2. The first kind is also imported into the plains of India from Assam in small egg-shaped baskets.

THALICTRUM FOLIOLOSUM *DC.*

Fig.—*Royle Ill., t.* 51.

Hab.—Temperate Himalaya, Khasia Hills. The root.

Vernacular.—Pílíjarí, Shuprak (*Hind.*), Gurbianí, Pashmaran (*Punj.*).

History, Uses, &c.—The genus Thalictrum is found in the temperate and cold northern regions of Asia, it is very rare in the South, but one species, *T. Dalzellii,* is found on the mountains of the Western Peninsula. In Europe *T. flavum,* under the names of *Meadow Rue, Rue des près, Fausse rhubarbe, Rhubarbe des pauvres, Unächte rhabarber, Wiescurante* and *Pigamo,* has long been used as a rustic medicine on account of its tonic and aperient properties. *T. foliolosum,* and perhaps another species from Arracan, have been used for a similar purpose in India from an early date. It is, perhaps, the Pitaka of Sanskrit writers. We have been able to identify as Thalictrum root the drug which is occasionally to be seen in the shops under the name of *Piaranga,** and which is treated of at great length in the Makhzan-el-Adwiya as a root which is brought from Arracan to Sylhet and Islamabad, and thence distributed to other parts of India. The people of Arracan appear to consider it as a panacea. The following information as to the properties of *Pilijari* is contained in the *Bengal Dispensatory,* where the result of a trial of the root, supplied from the Saharunpore Gardens, is related :—"Five grains of the powder, or two grains of the watery extract given three times a day in some cases prevented, and in others moderated, the accession of fever, and at the same time acted gently on the bowels. The only sensation experienced was warmth at the epigastrium and a general comfortable feeling." (*Beng. Disp.* p. 161.) The Piaranga of the shops in the form of a tincture has been administered to some extent at the European General Hospital, Bombay, and found to be a good bitter tonic. Recently the root of *T. foliolosum* obtained from the Superintendent of the Saharanpore Gardens has been used with very satisfactory results in Bombay as a remedy for atonic dyspepsia accompanied with a febrile condition of the system. (*Dr. Pechey.*)

Description.—Roots long, nearly straight, without rootlets, stout and woody, from ½ inch or more to ¼ inch in diameter

* Probably the same drug as the Pia-amou-leck of Ainslie.

Bark smooth, wrinkled longitudinally, yellowish brown; wood hard, very porous, and of a bright yellow colour, when wet it stains the fingers yellow. Magnified, the porous woody stem is seen to be traversed by medullary rays consisting of several rows of elongated cells: the bark shows a brown suber, and numerous rows of tangentially extended cells; opposite the terminations of the medullary rays, the cells take a rounded form and their arrangement becomes irregular; between the terminations of the medullary rays there is a large deposit of yellow colouring matter with thickening of the cell walls, forming yellow columns which extend to the suber and often end in patches of liber cells. The root at first sight might be mistaken for liquorice root; it is extremely bitter.

Chemical composition.—Thalictrum root contains a large quantity of berberine, so combined as to be readily soluble in water.

Commerce.—It occasionally appears in the shops in small quantities as Piaranga root. Supplies can be obtained, if ordered from Mussoorie, through the Superintendent of the Government Gardens.

CLEMATIS TRILOBA, *Heyne.*

Hab.—Mountains of Western India.

Vernacular.—Morwel (*Mar.*).

This plant, and probably another Himalayan species, *C. nepalensis, Dc.*, is mentioned by Sanskrit writers under the name of Laghukarni (light-ear) as a remedy in leprosy, blood diseases, and fevers.* In the Concan the juice of the leaves mixed with that of the leaves of *Holarrhena antidysenterica* is dropped into the eye to cure staphyloma; about two drops are used.

* The *Clematis vitalba, Linn.* *κληματίς ἑτέρα* of Dioscorides was used for similar purposes by the Greeks. The plants of this genus have acrid properties. Braconnot has observed that the active principle may be distilled with water and is soluble in fixed oils.

Description.—Climbing, all softly silky; leaves small, on longish petioles, simple or ternately divided, elliptic ovate or cordate, 3-nerved. Panicle many flowered; lower bracts leafy, flowers 1½ to 2 inches diam., white, appear in September; sepals 4 to 6, membranous, oblong, silky outside; filaments narrow, linear, glabrous. Many other species of Clematis grow in the temperate Himalaya, but do not appear to be used medicinally.

ACTÆA SPICATA, *Linn., Eng. Bot.* 13, 918.

Baneberry (*Eng.*), Racine de Saint Christophe (*Fr.*).

Grows in the temperate Himalaya from Bhotan to Hazara; it is also a European plant, and a variety with red berries is well known in America. It does not appear to be known as a medicinal plant to the Hindus; its chemical constitution is the same as that of *Cimifuga racemosa.* (*See* next article.) It is probably the Actæa of Pliny, 27, 26.

CIMIFUGA FŒTIDA, *Linn., Lam. Ill.* 487.

Bugbane (*Eng.*), Cimicaire (*Fr.*).

Is a native of the temperate Himalaya from Bhotan to Cashmere; it also occurs in Europe and Siberia. We have no knowledge of its use by the Hindus. In America *C. racemosa, Elliot,* (*Actæa racemosa, Linn.*), Black Cohosh, is used medicinally and is a depressant of the nervous and vascular systems, causing giddiness, nervous tremour, depression of pulse, nausea, and increased pulmonary and cutaneous secretion; in excessive doses it is an irritant emeto-cathartic and often causes violent delirium. The plant affords a crystalline neutral principle slightly soluble in ether and water, freely so in chloroform and alcohol. The latter solution has a pungent acrid taste. *C. fœtida* has not been examined.

The medicinal plants of minor importance belonging to the *Ranunculaceæ* and known in India are the following:—

Anemone obtusiloba, *Don., Royle Ill.* 52, t. 11, f. 1, is a native of the temperate and Alpine Himalaya, the root of

which, Stewart says, is mixed with milk and given internally for contusions, and used externally as a blister. Persian and Arabian medical writers describe several kinds of Anemone under the name of Shakayak-el-Naaman; they copy closely from the Greeks, with the addition that these plants are used with Walnut husks for dyeing the hair black. (*Cf.* Dios. II., 167; Pliny, 21, 94.)

Caltha palustris, *Linn.*, *Eng. Bot.* 8, 506. The Marsh-marigold is a native of marshes in the western temperate Himalaya. It is a common European plant. The natives of India consider the roots to be poisonous.

Delphinium Brunonianum, *Royle*, *Bot. Mag.* t. 5461.

Vernacular.—Sámp-phali. (*Hind.*) Is a native of the Punjab Himalaya, and is prized for its strong scent of musk. It is offered to idols, and Aitchison says that the juice is used to destroy ticks in animals. (*Journ. Linn. Soc.*, XVIII., p. 25.)

Delphinium cœruleum, *Jacq.*, *Voy. Bot.* 7, t. 6.

Vernacular.—Dakhangú. Is a Punjab plant, the root of which is used to kill maggots.

Delphinium denudatum, *Wall.* Is also a Punjab plant. Stewart says the root is chewed to cure toothache.

Peonia emodi, *Wall.*, *Bot. Mag.* 5719. Is the *Mamekh* of the Punjab and a native of the temperate Himalaya. It is said by Watt to be used in the same way as *P. officinalis*, *Linn.*

Ranunculus sceleratus, *Linn.*, *Eng. Bot.* 10, 681.

Vernacular.—Kabikaj (*Pers.*). Is a native of Northern India. It is one of the plants known as Batrachion to the Greeks, which Galen says should not be used on account of their acrid properties. The Romans called these plants *Ranunculus.* Fée and Hardouin consider it to be the same as the *Apiastrum* of Pliny and identify it with the *Ranunculus Sardous* of Croatz, the plant which produces a contraction of the mouth, famous

as the "Sardonic grin." It is called in English, Water-Crowfoot and Celery-leaved Crowfoot, and in Arabics, Kaf-es-saba. (*Cf.* Dios. II., 166; Pliny 25, 109.)

REMARKS.—Galen tells us that the Anemones are emmenagogue and galactagogue, and have acrid, drawing, cleansing and opening properties; when chewed they increase the secretion of saliva. The juice cleanses the brain when administered by the nostrils, and lessens or removes opacities of the cornea; it cleanses ulcers and cures scaly skin diseases if applied locally, &c. In Europe the drug appears to have fallen into disuse until about the end of the eighteenth century, when Störk again brought it to notice, and latterly in America several species of Anemone, under the name of Pulsatilla and their active principle anemonin, have been rather extravagantly praised as remedies for a long list of diseases. When pure anemonin is given to rabbits in doses of from 5 to 10 grains, it reduces the pulse, and respiration rate and the temperature; causes dyspnœa and stertor, debility, and then paralysis of the limbs, stupor, dilatation followed by contraction of the pupil, and death without convulsions. On dissection, the heart and great vessels and the veins of the brain and medulla are found distended with dark blood. (*Clarius.*) Externally it acts as an irritant to the skin. The extract and tincture of the plant differ from pure anemonin, inasmuch as large doses cause inflammation of the stomach and bowels and death with convulsions. The cause of this difference has not been ascertained. Applied to the tongue, both the drug and anemonin cause a sense of burning followed by numbness. In medicinal doses, (4 to 5 grains of the herb or $\frac{1}{6}$ to $\frac{1}{2}$ a grain of anemonin) the drug is now considered to act as a general stimulant and diuretic.

The different species of Anemone and Ranunculus when distilled with water yield a distillate, from which ether extracts a very acrid yellow oil (anemonol) which is gradually, or more rapidly in the presence of water, converted into anemonin and anemonic acid, from which hot alcohol dissolves

the former. Anemonin forms colourless friable crystals, which are neutral, inodorous, and when fused exceedingly acrid; it is soluble in chloroform, but nearly insoluble in ether and water. Formula $C^{15} H^{12} O^6$. (*Fehling.*) Anemonic acid $C^{15} H^{14} O^7$ is a white crystalline very insoluble powder, which dissolves alkalis with a yellow colour.

Some species of Delphinium contain the alkaloids delphinine $C^{22} H^{35} NO^6$, and staphisagrine $C^{22} H^{32} NO^5$, the former very closely resembles aconitine in its physiological action and is antidotal to muscarine and digitalin; the latter paralyses the motor nerves like curare. Both of the alkaloids are soluble in alcohol, but delphinine may be separated from staphisagrine by means of ether in which the latter is insoluble.

MAGNOLIACEÆ.

ILLICIUM VERUM, *Hook. f.*

Fig.—*Bot. Mag. t.* 7005. *Star-anise tree* (*Eng.*), *Badianier* (*Fr.*).

Hab.—Cochin-China. The fruit.

Vernacular.—Bádián-i-khatai (*Pers.*), Anasphal (*Hind.*), Anna shuppu (*Tam.*), Bạdián (*Bomb.*), Anása-puvvu (*Tel.*).

History, Uses, &c.—It would appear that star-anise has long been in use in China and Japan, but was not known in India until a comparatively recent date. Persian works on Materia Medica, written about one hundred years ago, speak of it as a new medicine. The authors of the Pharmacographia trace its introduction into Europe as far back as 1588; in those days it came by way of Russia, and was known as Cardamomum Siberiense. Mr. J. G. Scott, in a paper read before the Royal Geographical Society, describing Cua-ai, where the Chinese and French

Commissioners met for the delimitation of Tongking, says: "Maize, white and red rice, and the star-anise seem to be what the people chiefly cultivate upon the hill slopes. The star-anise is an evergreen shrub, with a leaf not unlike the Bay, and a pentagonal fruit very highly scented. From this is obtained the oil called by the Tonkinese *Dau hoi* (scented oil) and by the French *Huile de badiane*. The Chinamen boil the fruit in a huge caldron with water, inside this caldron there is a small internal vessel filled with cold water, which is constantly renewed. The steam and oil are condensed on the sides of this vessel, and are drawn off by a small bamboo runlet into the receiver; another runlet allows the water from this pan to drain back into the boiler. One boiling lasts over a day and a half, and produces about 15 pounds of oil. A picul, 117 lbs. weight, of the oil costs between £30 and £40. At present the greater part of the star-anise oil goes into China."

In Native medicine star-anise is considered to be hot and dry in the second degree; and is described as carminative, expectorant, and diuretic; it is often given in infusion with tea, and is also mixed with food as a spice. In European medicine it is described as an aromatic, stimulant and carminative. It is a favourite adjunct to cough mixtures, and on account of its sweet taste is specially suitable as a carminative for children.

Description.—For a very complete description of the commercial article, see *Pharmacographia*, p. 21. An Indian species, *I. Griffithii,* occasionally finds its way into the market; it has narrower and more numerous carpels, one or two only in each fruit are fertile; a handful of fruit upon examination proved to be all provided with 13 carpels; they are of a dark reddish brown colour, much wrinkled on the under surface; the seeds correspond with those of *I. verum*; the taste is feebly aromatic at first, afterwards bitter and astringent. The oil of Star-anise is free from the peculiar fatty smell of aniseed oil. (*Umney.*)

Microscopic structure.—The fruit of *I. Griffithii* has the same structure as that of *I. verum*, but in the external loose dark brown layer of cells, hardly any globules of essential oil can be seen; on making sections for the microscope the knife is immediately stained black by tannin, which is not the case with *I. verum*; for a microscopic description of the latter article consult the *Pharmacographia*, p. 21. Wood-cuts of the fruits of *I. verum*, *I. religiosum* and *I. Griffithii* may be found in a paper by Mr. E. M. Holmes in the *Pharm. Journ.*, 3rd Series, XI., 489.

Chemical composition—Star-anise contains from 4 to 5 per cent. of volatile oil, which is chiefly solid and liquid anethol, like that of *Pimpinella Anisum*. The specific gravity is 0·978, molecular rotation 0° to 0·4, with the chloral reagent * it affords eventually a red colour like Ol. Fœniculi. Its other reactions are similar to those obtained with aniseed oil. Star-anise contains much sugar, probably cane. (*Eijkman.*) Umney has pointed out that the congealing point of the oil when at rest is about 35° F., whereas that of aniseed oil is about 50°. When stirred, the congealing point of both oils is from 50° to 60° F.

The fruit of *I. Griffithii* would appear to contain some bitter principle as well as tannin. According to J. F. Eijkman, the fruit of *I. religiosum*, which has poisonous properties, contains proto-catechuic acid, shikiminic acid and shikimipicrin. The latter would appear to be the poisonous principle; it forms large transparent crystals, melting at 200° C., which are freely soluble in water, forming a neutral solution with a very bitter taste. The formula is $C^7 H^{10} O^3$ or $C^{10} H^{14} O^4$. In the volatile oil of the leaves he discovered eugenol, shikimen and shikimol; the second is, he thinks, a terpine, and the last identical with safrol. (*Rec. Trav. Chim.* IV., 32—54, *Year-Book of Pharm.*, 1885, p. 171.)

Commerce.—Star-anise is shipped to India from China in large quantities, and two qualities are met with, selected in

* Alcohol saturated with H Cl.

boxes worth Rs. 17 per Surat maund of 37½ lbs., and broken in bags, value Rs. 14 per maund. The oil which comes from China in 12 catty tin jars sells for about Rs. 4½ per catty.

MICHELIA CHAMPACA, *Linn. var. Rheedii.*

Fig.—*Wight Ill. i., t. 5, f.* 6. Golden or Yellow Champa (*Eng.*), Champac (*Fr.*).

Hab.—Temperate Himalaya, from Nipal eastward; Pegu, Tenasserim, Nilgiris and Travancore. Commonly cultivated. The bark.

Vernacular.—Champa (*Hind., Beng.*), Shampang (*Tam.*), Pivalá-cháphá (*Mar.*), Ráe champo (*Guz.*), Sampangi-puvvu (*Tel.*), Sampage-huvvu (*Can.*).

History, Uses, &c.—There appear to be several varieties of Michelia which have been produced by cultivation. *M. Rheedii,* which is referred by Hooker and Thomson to *M. Champaca,* is cultivated in India for the sake of its yellow, sweet-scented tulip-like flowers, which are made into a wreath (*veni*) and worn by women at the back of the head. The Champa, in Sanskrit Champaka or Dipapushpa (lamp flower) appears to have been cultivated in India from a very early date; it has many synonyms expressing praise of its delicate form, golden colour and intoxicating perfume.

The bark is mentioned in the secondary list of the Pharmacopœia of India as having febrifuge properties; but the natives of India do not generally use it, nor is it to be met with in the shops. According to Rheede and Rumphius the flowers are diuretic and are used in gonorrhœa to relieve scalding, pounded with cocoanut-oil they are applied as a plaster to inflamed parts. The root is said to be emmenagogue, and the oil of the seeds is rubbed into the abdomen to relieve flatulence.

Description.—The fresh bark is covered externally by a light brown epidermis, which can be easily removed by friction; beneath this, it is of a reddish brown colour mottled with

longitudinal green stripes, and pale yellow scars of irregular form; the inner surface is yellowish and fibrous, taste feebly bitter, with a faint aroma. It contains tannic and gallic acids.

Microscopic structure.—It is chiefly remarkable for aggregations of large stony cells of a bright yellow colour. The parenchyme contains much starch.

MICHELIA NILAGIRICA, *Zenker.*

Fig.—*Zenker Plant. Ind. t.* 20. Hill Champa (*Eng.*).

Hab.—Higher mountains of the Western Peninsula and Ceylon. The bark.

Vernacular.—Shempangan, Sempagum (*Tam.*), Sapu (*Cing.*).

History, Uses, &c.—This tree, like the Champa, yields a valuable timber. The bark is said to have been made into decoctions and infusions and used as a febrifuge, but there is no evidence of its being used for that purpose at the present time.

Description.—The stem bark is covered with a light brown, corky layer, which scales off or may easily be removed when dry; it is brittle, and its irregularly broken surface is frequently beset with lichens and mosses. Between the cork and intermediate layer are pinkish masses of various forms. The surface of the middle layer is pale brown; in the fresh state it is marked with longitudinal green stripes; it is hard and dense, and very much resembles the bone at the base of horns. A fracture shows that the middle layer is dense and of a reddish colour, and the inner layer dirty yellowish-brown, tough, and of fibrous consistence. The inner surface is russet-brown, and striated with the fine longitudinal marks of the white liber tissue. A transverse section touched with a drop of ferric chloride solution shows that tannin is present in the two inner layers only. The bark affords a light cinnamon-brown powder, slightly bitter in taste, with a faint terebin-

thinate odour. The bark of the branches and younger stems is uniformly pale brown, less bitter, and more aromatic.

Chemical composition.—The powdered bark gave 10·6 per cent. of moisture, and left 9·7 per cent. of ash. It contained a volatile and a fixed oil, acrid resins, tannin, giving a greenish-black colour with ferric salts, sugar, a bitter principle, mucilage, starch, calcium oxalate, &c. Search was made for alkaloids and mannite with negative results. A decoction did not give the usual blue colour with iodine until a considerable quantity of the reagent had been added, a reaction peculiar to cinnamon and cassia barks.

Commerce.—The oil of *Michelia nilagirica* which was stated (*Pharm. Journ. Oct.* 22, 1887, p. 344,) to be obtained from this bark, was in reality distilled from the bark of *Cinnamomum Wightii*, a tree found on the hills of Southern India.

ANONACEÆ.

ANONA SQUAMOSA, *Linn.*

Fig.—*Rheede, Hort. Mal. iii.*, 29; *Bot. Mag.* 3095; *Gartn. Fruct. ii., t.* 138. The Custard Apple tree (*Eng.*), Cachiman (*Fr.*).

Hab.—Tropical America, cultivated in India. The seeds, leaves and bark.

Vernacular.—Sitáphal (*Hind., Mar.*), Sita-pullum (*Tam.*), Ata, Lúna (*Beng.*), Sita-pundu (*Tel.*), Atta (*Cing.*).

History, Uses, &c.—The custard-apple has been long naturalized in India, and has received the Sanskrit name of Gandhagátra. The seeds, leaves, and immature fruit, contain an acrid principle which is destructive to insect life; the seeds are much used by the natives for removing lice from the head;

they require to be applied with caution; for if any particles get into the eye, much pain and redness is produced. The author of the Makhzan notices the poisonous action of the seed upon lice, and says that when applied to the os uteri, they cause abortion. The fruit is called Sharifah and Káj in Persian. Rheede states that the ripe fruit mixed with salt is used as a maturant. The root is considered to be a drastic purgative, and is administered by the natives in atrabilis or melancholia, much as Hellabore was by the Greeks. In the Antilles, Guiana and Reunion the leaves are employed to make a sudorific infusion (thé Corrossol), and in India the crushed leaves are applied to the nostrils of women suffering from hysterical or fainting fits.* The leaves are also used to destroy maggots in sores, and to assist in removing the Guinea-worm.

Description—Seed dark brown, polished, with two lateral ridges, tapering towards the umbilical end, where there is a prominent ring, with a central pit, length about five-eighths of an inch, breadth two-eighths, albumen large, ruminated, embryo minute. Leaves oblong, obtuse or acuminate, glaucous beneath, 2—3 by $\frac{3}{4}$—$\frac{1}{2}$ inch, pubescent when young, when dried black, odour when crushed pungent and offensive.

The fruit is giobose or ovoid, light green, tuberculous, the size of a large apple, and is composed of the numerous, confluent, ripe carpels, each of which contains one large seed, pulp sweet, of a delicate spicy flavour, easily digested.

Microscopic structure.—The testa of the seeds is composed of two sets of yellow rod-like cells, with a narrow central cavity, the outer set are arranged vertically but the inner project into the albumen and divide it into numerous small bundles. The albumen consists of large polyhedral cells filled with starch.

Chemical composition.—The seeds yield an oil and resins; the latter appear to be the acrid principles.

* Rheede notices the use of the unripe fruit in a similar manner in vertigo.

The bark has been examined by Pedler and Warden, who found indications of an alkaloidal principle, but failed to isolate it in a pure state; they also found an acid resin insoluble in ether, and two resins soluble in ether; as well as a white crystalline principle soluble in alcohol and ether, but insoluble in water or dilute acids, and a viscid yellow neutral resin-like body.

BOCAGEA DALZELLII, *H. f. & T.*

Hab.—Forests of the Concan and Travancore. The leaves.

Vernacular.—Sájeri, Kochrik, Hárkinjal (*Mar.*).

Description.—Leaves polished, narrow-oblong, acute or obtuse, 5—9 inches long by 1—2 broad, coriaceous, serrated, base acute or rounded; flowers white; carpels globose, smooth, about one inch in diameter, usually containing two mature seeds. Graham, under the name of *Guatteria laurifolia*, describes this tree as like the Portugal laurel, and says that it flowers in November, and bears fruits the size of a marble, which when cut open have an agreeable smell like the wild English Angelica. In the Concan, the leaves are used as a fomentation in rheumatism by the natives; they have a pungent, astringent and bitterish taste. The tree yields a valuable reddish timber which is used in house building.

Chemical composition.—The leaves contain tannin, giving a blue-black precipitate with ferric salts, and a very small quantity of gallic acid. The aqueous extract contains a ferment which produces a pungent alliaceous odour as soon as an infusion is made of the leaves. It is precipitated from its aqueous solution by alcohol, and is to some extent dissolved again by heat. The distillate is oily, with a pungent odour and taste, and neutral in reaction. The leaves also contain a crystalline body extracted by boiling alcohol from the marc left by ether and cold alcohol exhaustion; it is probably the body related to sinigrin of mustard seed, which gives the pungent property in contact with water. The leaves yield 7·8 per cent. of ash.

MENISPERMACEÆ.

JATEORHIZA CALUMBA, *Miers.*

Fig.—*Bentl. and Trim., t.* 13. Calumba (*Eng.*), Colombo (*Fr.*).

Hab.—Oibo, Mozambique. The root.

Vernacular.—Kalamb-kí-jer (*Hind.*), Kalamb kachri (*Bomb.*), Kalamba ver (*Tam.*), Kalamba-veru (*Tel.*).

History, Uses, &c.—Calumba grows in the forests of East Africa, along the Mozambique Coast, in the Zambesi country, and Madagascar; the Arabs call it Sák-el-hamám, 'dove's foot,' from the resemblance of the hairy ovaries with their three-parted stigmas to the leg and foot of a dove. The drug appears to have been first introduced into India by the Portuguese. In Africa it would seem to have been long used as a medicine in dysentery, and other affections of the bowels. Flückiger and Hanbury's researches have traced its introduction into Europe to the Portuguese, as far back as 1671. Shortly after this date, Francisco Redi noticed it as an alexipharmic. It would then appear to have been neglected until re-introduced by Percival in 1773; since then it has been in constant use in Europe as a mild tonic. The older English physicians in India probably became acquainted with it through the Portuguese The plant was introduced into Madras in 1805, and subsequently into Bengal and Bombay, but it appears now to have died out. Calumbin, the non-nitrogenous crystalline bitter principle occurring in Calumba-root together with berberine is usually represented as not possessing much physiological activity. Dr. Lauder Brunton says (*Pharmacology*, p. 757), it seems to have less action than berberine. But some experiments made with the separated crystalline principle, and reported by M. Houdé (*Repértoire, March*, 1886, p. 113), point to it being a somewhat energetic substance, giving rise to vomiting and diarrhœa. In small doses it appeared to augment the secretion of bile, of the glands

of the stomach, and the intestine; after full doses the liver appeared to undergo granular fatty degeneration. A dose of 10 centigrams administered to fowls caused death, preceded by digestive disturbance and frequent evacuation. It is thought that if it were not that calumbin is present in Calumba in only small amount (0·35 to 0·4 per cent.) it would prove an inconvenient constituent in the administration of the drug. (*Pharm. Journ.*, 1886.) Calumba appears to owe its tonic action chiefly to berberine (*see* Berberis); it also possesses the advantage of containing no tannin, and consequently does not form an inky mixture with salts of iron. It is used in atonic dyspepsia and debility of the digestive organs, and appears to increase the secretion of bile. Trousseau and Pidoux recommend it especially when there is subacute inflammation of the gastric mucous membranes, with a bitter taste in the mouth, heat and pain at the epigastrium, nausea, slight fever and perhaps diarrhœa.

The powdered root has been used for dressing unhealthy sores.

Description.—The drug consists of nearly round or oval transverse slices of the root, varying much in size; these, when freshly imported, are of a light, bright greenish yellow colour, and have their edges covered by a wrinkled, corky epidermis; the surface of the slice shows a central portion, often much contracted in the middle, the vascular bundles standing out as rough projections, and a cortical portion from two to three-eighths of an inch thick. Calumba is light and breaks easily with a short starchy fracture, the odour is mossy, and the taste very bitter.

Microscopic structure.—Commencing externally we find a range of tabular cells forming the suber; within this, a broken line of thick-walled yellow cells; and next a cellular parenchyme loaded with starch and yellow colouring matter, making up the bulk of the bark, and intersected by radiating bands of liber tissue. The central portion of the root consists of a starchy parenchyme, intersected by radiating bands, formed

of bundles of large vessels, which are more or less surrounded by a layer of wood cells. The starch granules are very large and ovoid.

Chemical composition.—The root contains calumbin, berberine and calumbic acid. Calumbin may be obtained by treating the root with alcohol of 75 per cent., the alcohol is recovered, and the residue, after evaporation, dissolved in water, and shaken with ether, which takes up fatty matters and the calumbin; the latter is purified by crystallization from boiling absolute ether; it forms right rhombic prisms, and is neutral and very bitter. Calumbic acid was obtained by Baedecker by adding hydrochloric acid to the product obtained by the treatment of an alcoholic extract of calumba by lime water; it forms strongly acid white crystalline flakes. Both calumbin and calumbic acid are very sparingly soluble in cold water or cold alcohol, and ether. (*Dict. de Chimie; Wurtz.*, Vol. 1, p. 959.) Baedecker has pointed out a connection between these three bitter principles.

If we suppose a molecule of ammonia NH^3 to be added to calumbin $C^{42} H^{44} O^{14}$, the complex molecule thence resulting will contain the elements of berberine $C^{20} H^{17} NO^4$, calumbic acid $C^{32} H^{24} O^7$, and water $3 H^2O$ (*Pharmacographia*, p. 25). Duquesnel has recently published the following process for obtaining calumbin. Exhaust the powdered root with 95 per cent. alcohol, recover the alcohol, treat the syrupy residue with chloroform. Filter the chloroform solution and evaporate; treat the residue with 60 per cent. alcohol which dissolves most of the colouring matter. The residue, which contains the calumbin, is dissolved in strong alcohol; decolorised with animal charcoal and crystallized. The yield should be 0·35 to 0·4 per cent.

Commerce.—Calumba root is imported into Bombay from the Mozambique Coast to the extent of from 200 to 400 bales annually.

The bales are of matting, and contain about one cwt. each, value Rs. 3½ per Surat maund of 37½ lbs.

ANAMIRTA COCCULUS, *W. & A.*

Fig.—*Rheede, Hort. Mal. vii., t.* 1; *Bentl. and Trim. t.* 14. Cocculus Indicus (*Eng.*), Coque du Levant (*Fr.*).

Hab.—Concan, Malabar, Eastern Archipelago, Eastern Bengal, Assam. The fruit.

Vernacular.—Kakámari (*Hind., Can., Tel., Beng.*), Kákphal (*Guz.*), Karwi (*Mar.*), Kákkáy-kolli-virai (*Tam.*), Heuber, Netrmala (*Punjab*)

History, Uses, &c.—This plant, which is a large climbing shrub with rough corky bark, is probably the Kákaphala of Sanskrit writers; its properties must have been known to the Hindus from an early date, and the fruit appears to have been long in use as a remedy in certain skin affections, possibly of parasitic origin. The Arabs were probably also acquainted with it, but there is no satisfactory evidence upon this point to be gathered from their writers upon Materia Medica. Sprengel would make it the Mahir-harj of Ibn Sina, but this is evidently incorrect; as Ibn Sina describes that plant as "like *Shibram* (Tithymalus), which some people class among the milky shrubs." According to Flückiger and Hanbury, Ruellius was the first European writer who mentioned it (*De Natura Stirpium, Paris,* 1536), under the name of Cocci orientis. Gerarde calls it Cocculus Indicus; it also bore the name of Coccole di Levante (Levant berries), from its being introduced into Europe through the Levant ports. In the Concan the juice of the leaves with that of the root of *Gloriosa superba* is used to kill Guinea-worms. Rumphius, vii., 18, notices its use to kill fish, and also birds of Paradise, by poisoning the holes full of rain water in the trees they frequent. He says that in Ceylon and Malabar they catch wild cattle, &c., by poisoning Jack fruits with it, and placing them in the woods.

Picrotoxin, the active principle of the seeds, has been found useful in the night sweats of phthisis in doses of $\frac{1}{120}$ to $\frac{1}{60}$ of a grain; it is also employed to destroy pediculi in the form of

an ointment (10 grs. to 1 oz.), and is official in the United States Pharmacopœia.

When administered internally it stimulates all the motor and inhibitory centres in the medulla, especially the respiratory and vagus centres. It also irritates motor centres, either in the cerebrum or in the medulla and cord, producing in all vertebrates alternating epileptiform spasms, with periodic stoppage of the motions of the diaphragm and slowness of the pulse. The spasms often take the form of swimming, running backwards or round in a circle (manège movements), or rolling of the body on its axis. The temperature is somewhat raised. (*Lauder Brunton.*) Some preliminary experiments made by Professor Arpad Bokai go far to show that picrotoxin is probably the best antidote for morphia poisoning. It is said to prevent paralysis of the centre of respiration, by which death from morphia is caused. It has also exactly the opposite effects of morphia on the pressure of the blood.

Description.—A somewhat reniform purple fruit, the size of a small grape, growing in a long bunch, each branch of which supports from 1 to 3 of the drupes. The dry fruit is about the size of a large pea, dark brown, and wrinkled; below the concavity on one side there is a circular scar, to which a portion of the peduncle sometimes remains attached; above it is a small pointed projection, the remains of the style; within the dried pulp is a thin shell, which at the concave part of the fruit dips in deeply to form a placenta, which projects in the shape of two lobes into its cavity, upon these the kernel is moulded, and has consequently a cup-shaped form, the cavity of the cup being marked by a longitudinal ridge, corresponding to the fissure between the two lobes of the placenta. The kernel consists of two layers of albumen, which, when separated, disclose a superior radicle, from which two thin cotyledons diverge, narrow at first, but afterwards widening. Cocculus Indicus is very bitter, and if kept long has a rancid oily smell.

Microscopic structure.—The albumen is composed of polyhedral cells containing crystals of fatty matter.

Chemical composition.—The pericarp is said to be emetic, and to contain two crystallizable tasteless substances, menispermine and paramenispermine, but this is doubtful, and requires confirmation. Picrotoxin, a crystalline substance, was discovered in the seed by Boullay in 1812; it is the poisonous principle, and is soluble in water and alkalis. Flückiger and Hanbury give the following summary of its properties:—"Picrotoxin does not neutralize acids, it dissolves in water and in alkalies; the solution in the latter reduces cupric oxide like the sugars, but to a much smaller extent than glucose. The alkaline solution is not precipitated by chloride of ammonium. The aqueous solution is not altered by any metallic salt, or by tannin, iodic acid, iodohydrargyrate or bichromate of potassium; in fact, by none of the re-agents which affect the alkaloids. It may thus be easily distinguished from the bitter poisonous alkaloids, although in its behaviour with concentrated sulphuric acid and bichromate of potassium, it somewhat resembles strychnine as shown in 1867 by Köhler. Picrotoxin melts at 200° C.; its composition $C^9 H^{10} O^4$, as ascertained in 1877 by Paternò and Oglialoro, is the same as that of evernic, hydrocoffeïc, umbellic and veratric acids." (*Pharmacographia*, p. 32)

By fractional distillation from Benzol, Barth and Kretschy (1880) separated picrotoxin into three bodies. One, for which the name picrotoxin was retained, melts at 201° C., and has the composition $C^{15} H^{16} O^6 + H^2 O$. The second, *picrotin*, $C^{25} H^{30} O^{12}$, has similar properties, but melts at at 250° C., is less freely soluble in benzol, and is not poisonous. The third compound, *anamirtin*, $C^{19} H^{24} O^{10}$, remains in the mother liquor on re-crystallizing prirotoxin from water; it is but slightly bitter, is not poisonous, and its alkaline solutions do not reduce metallic salts. Warnecke has obtained from the fruit 5·20 per cent. of ash.

Toxicology.—This drug is occasionally used in Madras and Bombay as a cattle poison. During the last ten years four cases have been reported. In Bombay one case has been

reported in which it was used to facilitate the commission of theft. The symptoms are stomach ache, nausea, vomiting, tetanic convulsion, insensibility and sometimes delirium. Dr. Burton Brown notices its use as a poison in the Punjab.

Commerce.—Cocculus Indicus is brought to the Western ports in large quantities for exportation to Europe; it is hardly ever used in India, and is seldom to be seen in the druggists' shops. Value, Rs. 3 per Surat maund of 37½ lbs.

CISSAMPELOS PAREIRA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 15.

Hab.—Tropical and sub-tropical India. Cosmopolitan in warm regions. The root.

Vernacular.—Dakhnirbishí, Pahári, Hárjori (*Hind.*), Pahármúl (*Mar.*), Páta (*Tel.*), Tikri, Katorí (*Sind, Panjab*), Karandhis (*Guz.*), Ponmutootai (*Tam.*).

History, Uses, &c.—The plant appears to have been long in use as a bitter tonic and diuretic in Northern and Southern India, and is mentioned by Ainslie. Chakradatta recommends it in fever with diarrhœa and in internal inflammations; it is combined in native practice with bitters and aromatics. In Europe it has never been an article of commerce, though for a long time it was supposed to produce the Pareira root of the shops (*confer. Pharmacographia, p.* 25). The Sanskrit names are Ambáshta, Páthá and Venívela (braided creeper), Pahadamula and Ákanádi. In the Punjab and Sind the leaves and roots are employed in the cure of ulcers and in Pudukota for dysentery. The drug is not used in Europe; it appears to act as a mild tonic and diuretic. It is reputed to be antilithic.

Description.—The root is about half an inch in diameter, bark light brown, marked with longitudinal furrows, and transverse constrictions, sometimes very crooked and knotty, from

growing in stony ground, seldom branched, fracture fibrous, bark corky, and thick for the size of the root, wood yellowish, in from 10 to 15 wedge-shaped bundles, containing many large vessels, and separated by narrow medullary rays; odour none; taste very bitter.

Microscopic structure—It cannot be distinguished from several other Menispermaceous roots common in India.

Chemical composition.—The pelosine or cissampeline of Wiggers, which Flückiger has found to be identical with bebeerine, exists in this root to the extent of about ½ per cent. (*Flückiger.*) Pelosine is amorphous, nearly insoluble in water, somewhat soluble in ether and carbon bisulphide, freely soluble in chloroform and acetone, also in alcohol and benzol; its nitrate is sparingly soluble, and its acetate is precipitated by sodium phosphate, by the group re-agents for alkaloids, and by iodide, ferrocyanide, ferridcyanide, and chromate of potassium; the precipitate with phosphomolybdic acid dissolves in ammonia with a blue colour. The formula of bebeerine is $C^{19} H^{2} NO^{3}$.

Stephania hernandifolia, *Wall.*, *Wight Ic. t.* 939, extending from Nipal to Chittagong, Singapore and Ceylon, has similar properties, and is known by the same native names as *Cissampelos Pareira.* It is the Ágnád (Ákanádi) of Bengál, where the striated stems are sold in the bazars; but it seems probable that the true Sanskrit name of this plant is Vanatiktika.

TINOSPORA CORDIFOLIA, *Miers.*

Fig.—*Rheede, Hort. Mal. vii.*, 21; *Bentl. and Trim.*, *t.* 12.

Hab.—Tropical India. The stem.

Vernacular.—Gurach, Giloe, Gulancha (*Hind.*, *Beng.*), Gulwail, Guloe, Gharol (*Mar.*), Típpa-tíge (*Tel.*), Shindíl-kodi (*Tam.*), Amrita-balli (*Can.*), Rassakinda (*Cing.*), Gurjo (*Sikkim*), Amritwel (*Goa.*), Gado (*Guz.*).

History, Uses, &c.—A well-known medicinal plant, long in use in Hindu medicine, and called in Sanskrit Guduchi, Pittaghni (bile-destroying), Bhishakpriya (dear to physicians), Nirjara (not perishing), &c. It is considered to be cold and dry, or according to Arabic and Persian writers, hot and dry in the first degree. In native practice it is much valued as an antiperiodic in fevers, and as a tonic and alterative; it is also credited with aphrodisiac properties.* The fresh plant is said to be more efficient than the dry; it is taken with milk in rheumatism, acidity of the urine and dyspepsia. The juice with Pakhanbed and honey is given in Gonorrhœa, and is an ingredient in Paushtiks given in *Phthisis*. In Guzerat, a necklace called Kamalá-ni-málá (jaundice necklace) is made of small pieces of the stem, and is supposed to cure that disease. The stem, if placed upon a bush in the open air, will retain its vitality through the hot season, and when the rains commence, put forth leaves and long whipcord-like roots, which soon reach the ground, whence the Sanskrit synonym Chinnaruha, or, growing when cut. The plant is very common in many parts of India, and may always be obtained in the green state. Elephants are very fond of the stems, and the hill tribes in Sikkim give it to their cattle to cure pains in the stomach. The dry stem is to be seen in every drug shop; from it is prepared a kind of starch known in Hindustani as Giloe-ka-sat, and in some parts of India as Palo. It is prepared by powdering the stem and washing out the starch with water; the latter retains a little of the bitterness of the drug. *T. cordifolia* appears first to have attracted the notice of Europeans in India at the early part of the present century, and to have been favourably spoken of by those who have tried it as a tonic, antiperiodic and diuretic, but it has never come into general use in European practice. It is now official in the Pharmacopœia of India, and has lately (1884) been re-introduced to the notice of the profession in Europe as a specific tonic, antiperiodic and diuretic. (*Zeitschrift des Oesterr. Apoth. Ver.*, 1884, 312.)

* For original Sanskrit prescriptions, see Dutt's Hindu Materia Medica, p. 105; most of them contain several other equally active remedies.

Description.—The fresh stem has a green succulent bark, covered by a thin brown epidermis, which peels off in flakes; it is studded with warty prominences, and here and there gives off roots and branches bearing smooth heart-shaped leaves, and bunches of red berries; when dry it shrinks very much, and the bark separates from the wood, and becomes of a dull brown colour; the latter consists of a number of wedge-shaped bundles; the taste is very bitter; the odour not in any way peculiar.

Microscopic structure.—The suber consists of tabular cells, and thick-walled yellow cells, in alternate layers; the woody portion is not to be distinguished from that of several other Menispermaceous plants common in India.

Chemical composition.—The extract called Palo and Sat-i-giloe is simply starch, which, through not having been washed, retains some bitterness, that sold in the bazaars is usually nothing but common starch. The stem has been examined by Flückiger (1884) by boiling it with alcohol and a little hydrate of calcium, the alcohol was then evaporated and the residue extracted by means of chloroform. The latter liquid was found to contain an alkaloid in very small quantity; on evaporating it and dissolving the residue by means of acidulated water, a solution was obtained, which proved to contain merely a trace of berberine. The alcoholic extract after it had been exhausted by chloroform as above stated, was dissolved in boiling water and precipitated by tannic acid, avoiding an excess of the acid. The deposit thus obtained was mixed with carbonate of lead, dried and exhausted with alcohol, which on evaporation yielded the bitter principle. By boiling this bitter principle with dilute sulphuric acid, sugar was produced and it lost its bitterness. Neither the original bitter principle or the product derived from it could be crystallized.

Commerce.—The stems are collected and dried by the country people who bring them for sale to the towns. Value, Rs. 2½ per Surat maund of 37½ lbs.

COCCULUS VILLOSUS, *DC.*

Fig.—*Pluk. Am.*, *t.* 384, *f.* 3, 7.

Hab.—Tropical and subtropical India. The roots and leaves.

Vernacular.—Jamti-ki-bel, Farid-buti (*Hind.*), Vasanvel, Tána (*Mar.*), Dagadi (*Can.*), Chipuru-tige, Katle-tige (*Tel.*), Haér (*Beng.*), Káttuk-kodi (*Tam.*), Pátála-galori (*Guz.*).

History, Uses, &c.—A very widely-distributed plant of climbing habit, very common everywhere; it has no doubt been long in use as a domestic remedy in all parts of the country, but few of the native works on Materia Medica notice it. The Sanskrit names are Pátála-gárudi, Vásadani and Vásana-valli, "giving a fragrant perfume." It is a disputed point whether this plant or the *Pedalium murex* is the true Faríd-bútí upon which Sheik Faríd is reputed to have sustained life for some time. The juice of its leaves mixed with water has the property of coagulating into a green jelly-like substance, which is applied externally by the country people under various circumstances on account of its cooling nature, and is also taken internally sweetened with sugar as a cure for Gonorrhœa. Pliny (24, 99) mentions two plants, Coracesta and Callicia, which, according to Pythagoras, were used by the Magi to congeal water. The root is said to be alterative, and to be a good substitute for Sarsaparilla. Roxburgh says that a decoction of it in goat's milk flavoured with long pepper is administered in rheumatic and old venereal pains, and is considered heating, laxative and sudorific. (*Fl. Ind.* III., 815.) The juice of the ripe berries makes a durable, bluish-purple ink. (*Brandis.*) In the Concan the roots rubbed with Bonduc nuts in water are administered as a cure for belly-ache in children, and in bilious dyspepsia they are given in 6 massa doses with ginger and sugar; they are also an ingredient with a number of bitters and aromatics in a compound pill which is prescribed in fever.

Description.—Leaves 2 to 3 by 1½ to 2 inches, sometimes sublanceolate, retuse or obtuse, and mucronate; sometimes

three-lobed, base subcordate or truncate, when young villous on both surfaces; petiole ½ inch long. Root very crooked and twisted upon itself, keeled, seldom branched, but giving off a few thin fibrous rootlets; external surface light brown, nearly smooth, transverse section pale yellow, marked with radiating darker yellow lines; odour peculiar, acrid; taste disagreeable and bitter.

Chemical composition.—The air-dried stems and roots were well bruised in a mortar and extracted with rectified spirit in a Thorn's extractor. The resulting tincture was then evaporated at a low temperature on a water bath till free from alcohol. Water was added to the viscid extract, and the turbid mixture, which possessed a strong acid reaction, was repeatedly agitated with ether. During agitation a large amount of dark, soft resinous-looking matter separated and adhered to the bottom of the bottle. The original extract was thus divided into three portions—ethereal solution A, separated resin B, aqueous residue C.

The ethereal solution A, which was of a dark yellowish-brown hue, was agitated with dilute hydrochloric acid; during agitation the aqueous acid solution became turbid from the separation of dark brown flocks. The ether was separated and was of a yellowish colour; it left on spontaneous evaporation a yellowish-green soft resin, which possessed a very fragrant odour, not unlike that of Tolu balsam. Treated with benzol it was partially soluble. No further examination was made of this portion.

The aqueous solution filtered from the brown flocks above mentioned, was of a dark brown colour. The addition of ammonia caused the separation of pinkish flocks, and the solution acquired a reddish hue. The turbid solution was now agitated with chloroform-ether which acquired a pink colour. The separated chloroform-ether left on evaporation a pink residue, non-crystalline, soluble in alcohol, the colour being that of a tincture of Sander's wood. The alcoholic solution did

not exhibit any fluorescence, and the colour was the same when viewed by either reflected or transmitted light; examined spectroscopically there was marked absorption towards the violet end of the spectrum, with a slight absorption in the yellow, but no bands. The addition of dilute acids to the alcoholic solution altered the colour to dirty yellow. Some of the dry extract was treated with water, and gently heated, a dark resin-like mass was insoluble; the aqueous solution had an acid reaction, and a fragrant odour. A few drops of dilute H Cl. were now added and the clear yellow solution filtered from insoluble matter, and agitated for a very brief period with chloroform. The chloroform, of a yellow colour, was separated; on evaporation the extract was not wholly soluble in dilute H Cl. The filtered acid solution gave with alkalies a pink colour, while brick-red flocks separated, not soluble in excess: the addition of dilute acids immediately destroyed the red colour. With potassio-mercuric iodide, phospho-molybdic acid, platinic and auric chlorides, and picric acid, marked amorphous precipitates were yielded.

The aqueous acid solution which had been agitated with chloroform for a short period only, was now rendered alkaline with ammonia and again agitated with chloroform. The chloroform was separated, and evaporated off at a gentle heat, the residue was dissolved in dilute H Cl., with alkalies white flocks separated, and the solution further gave precipitates with all alkaloidal re-agents.

These experiments would indicate that two principles were extracted, one possessing the properties of an acid, and yielding a red colour with alkalies; the other an alkaloid.

The reddish alkaline solution left after agitation with chloroform-ether, was gently heated to expel ether, and when cold acidified with dilute H Cl., when the colour changed to dirty green; the solution was then agitated with chloroform, which acquired an emerald-green colour. On evaporating off the chloroform a green varnish-like non-crystalline residue was left. The chloroform solution examined spectroscopically

showed some absorption towards the violet end of the spectrum, but no bands. The liquid did not exhibit any fluorescence, and was of the same colour viewed either by reflected or transmitted light. The extract was readily soluble in alcohol; more readily soluble in ether than in benzol. The addition of a few drops of dilute H Cl. and water, dissolved the greater part of it, the resulting solution being of a dirty green colour. The addition of alkalies caused the separation of pink flocks, and the solution became of the same colour. A precipitate was also yielded with the usual alkaloidal re-agents. Subsequent addition of an acid caused the liquid to regain its original green hue, and the solution when again agitated with chloroform coloured it an emerald green. The action of alkalies on the green chloroform extract was extremly marked, the slightest trace of an alkali being sufficient to determine the production of the pink coloration. Boiled with alcoholic potash the red coloration of the liquid was not destroyed, but on the addition of dilute acids yellow flocks separated, which were soluble in chloroform with production of a yellow solution without any tinge of green. The aqueous solution was also yellow.

These experiments appear to indicate that the reddish alkaline solution contained an acid principle associated with an alkaloid. It would appear that the alkaloid contained in this second fraction was similar to the one to which reference has already been made. The two acid principles, however, do not appear to be identical: in the one case the chloroform solution of the acid was yellow, in the other emerald green. In their behaviour towards alkalies they also differed in the tint of the colour reaction. These principles do not appear to be of the nature of ordinary chlorophyll, but possibly they may be allied to the colouring matter stated to be present in certain lichens, &c., or to decomposition products of chlorophyll.

Separated resin B, was soluble in alkaline hydrates, and reprecipitated in brown flocks by acids. The resin was not further examined.

Aqueous residue C—The filtered solution was rendered alkaline with ammonia and agitated with chloroform-ether, brownish flocks separated. The separated chloroform-ether left on spontaneous evaporation a transparent yellowish varnish-like residue. In order to purify this extract it was dissolved in dilute acetic acid in which, with the exception of a few flocks it was wholly soluble. The filtered solution was agitated with chloroform several times; finally the liquid was rendered alkaline and again agitated with chloroform. On separating and evaporating off the chloroform, a faintly yellowish transparent residue was left; this residue was practically insoluble in water: it was easily dissolved by alcohol, and also soluble in ether, but the solutions did not crystallize on slow evaporation. The alcoholic solution was bitter; it did not exhibit fluorescence. In dilute acids, especially tartaric acid, the extract was soluble, the resulting solutions being bitter. With nitric, hydrochloric, sulphuric, acetic, and tartaric acids no crystalline compounds could be obtained. From an acid solution alkalies precipitated white flocks, which were redissolved by acids. An acid solution responded to all the ordinary alkaloidal re-agents. A solution in sulphuric acid after boiling did not reduce an alkaline copper solution. A solution of the extract in dilute hydrochloric acid was precipitated by platinic chloride in excess, the amorphous light yellow precipitate collected on a filter, well washed, and dried in a vacuum over concentrated sulphuric acid. Two determinations of the metal in this salt yielded 19·07 and 18·91 per cent., respectively, of platinum, which gives a mean of 18·99 per cent. of platinum. During ignition of the platinum salt there was a very strong odour of benzoic acid. This principle had the properties of an alkaloid; at present its ultimate composition has not been determined. The chloroform which was first agitated with the original alkaline aqueous solution, left a reddish varnish-like residue, which also gave all the reactions of an alkaloid, and which appeared to be similar to the principle separated from the alkaline solution; the alkaloid being thus separable both from an acid and an alkaline solution by chloroform, &c.

This alkaloid was doubtless the one which was found associated with the colouring principle, and to which reference has already been made. The colouring principle gave similar reactions to the one already described. The original aqueous alkaline solution left after agitation with chloroform was filtered, and then agitated with amylic alcohol. The amylic alcohol solution was of a deep claret colour: it was agitated with dilute hydrochloric acid. The amylic alcohol on evaporation left a light green varnish-like residue insoluble in water or in dilute hydrochloric acid. The addition of ammonia to the solid extract dissolved a portion, the solution being of a damson-red colour. The residue insoluble in ammonia was of a dirty brown hue. The addition of acids to the ammoniacal solution precipitated pale greenish flocks.

The hydrochloric acid solution of the amylic alcohol extract was of a deep brown colour, carbonate of soda was added, which precipitated brown flocks, and the solution agitated with amylic alcohol. The amylic alcohol became of a damson red colour. On evaporation a damson coloured varnish-like residue was left, partially soluble in water acidified with hydrochloric acid; the solution was strongly bitter and harsh: a trace of tannin was present. The addition of alkalies occasioned the precipitation of white flocks: with the ordinary alkaloidal re-agents precipitates were obtained. The principle possessed the properties of an alkaloid, but appeared to differ from the first one described in being more easily soluble in dilute acids, and in possessing a much more marked bitter taste, accompanied by harshness. The amount isolated was far too small to admit of any examination of its platinum salt.

The colouring principles which have been isolated by the action of amylic alcohol were probably similar to those obtained earlier in the analysis by the action of chloroform, &c. The aqueous residue left after the action of amylic alcohol was not further examined.

Commerce.—Not an article of commerce.

COSCINIUM FENESTRATUM, *Colebr.*

Fig.—*Miers. in Hook. Bot. Mag., t.* 6458; *Contrib. iii.* 22, *t.* 88. Tree Turmeric, False Calumba (*Eng.*).

Hab.—Western Peninsula, Ceylon. The stem.

Vernacular.—Jhár-kí-haldí (*Hind., Bomb.*), Mara-manjal (*Tam.*), Dodamara-darasina (*Can.*).

History, Uses, &c.—The stem is said to have been long in use in Ceylon and Southern India as a bitter medicine, and as a yellow dye. We have not met with any account of it in native works; but there is reason to believe that it has sometimes been confounded with Darhalad, the stem of the Barberry. Ainslie was probably the first European physician who noticed it. He says:—"Mera Munjil is the Tamil name of a round yellow-coloured bitterish root, common in the bazaar, about one inch in circumference, employed in preparing certain cooling liniments for the head, and is also used as a yellow dye; it is brought from the mountains, but I have endeavoured in vain to ascertain the plant." Subsequently it attracted attention in Ceylon by being mistaken for Calumba, and some of it found its way to Europe, where it became known as False Calumba and Tree Turmeric; it is favourably noticed in the Pharmacopœia of India, and is used at the present time in the hospitals of the Madras Presidency as a bitter tonic. (*See Berberis.*)

Description.—Cylindrical woody stems, diameter 1 to 4 inches, covered with a pale corky bark; wood of a bright greenish yellow colour, and open porous structure, having no concentric rings, but conspicuous medullary rays; taste purely bitter. The wood is much less hard than that of the Barberry, and of a lighter colour.

Chemical composition.—Calumba wood was analysed by Perrins in 1853, and found to contain berberine. (*Phar. Jour.*, Vol. XII., pp. 180—500.)

Commerce.—It is an article of commerce in Southern India only.

The Menispermaceous plants of minor importance sometimes used medicinally, are the following:—

Tinospora crispa, *Miers.,* extending from Sylhet and Assam to Pegu and Malacca. It possesses the bitterness and tonic properties of *T. cordifolia,* and is known by the same vernacular names.

Cocculus Leæba, *D. C., Pluk. Am., t.* 384, *f.* 4, a scandent shrub of the Punjab, Sindh, and Carnatic, which is also found in Afghanistan, Arabia and Persia, has bitter and tonic properties similar to those of *Tinospora cordifolia.* It is known in the Punjab and Sindh as Ullar-billar and Parvati.

Tiliacora racemosa, *Coleb., Rheede Hort. Mal. vii., t.* 3; *Miers., Contrib. iii.* 76, *t.* 104, a climbing shrub found throughout tropical India and in Ceylon, is one of the three kinds of Mushadi used by the Telíngás as remedies for snake-bite. These three kinds are: Mushadi, *Strychnos Nux-vomica;* Naga-Mushadi, *Strychnos colubrina;* and Tiga-Mushadi, *Tiliacora racemosa.* Other vernacular names for this plant are Tiliakora (*Beng.*) and Bága-mushada (*Hind.*); it is bitter like others of the genus, and, it is hardly necessary to say, no antidote to snake poison.

Pericampylus incanus, *Miers.* Under the name of *Bárak-kánta,* slender Menisperaceous stems are sold in the Bengal bazars which appear to belong to this plant.

BERBERIDEÆ.

BERBERIS, ARISTATA, *DC.*

Fig.—*Bentl. and Trim., t.* 16. Nepaul Barberry (*Eng.*), Vinettier aristé (*Fr.*).

Hab.—Temperate Himalaya, Nilgiri Mountains, Ceylon.

B. LYCIUM, *Royle.*

Ophthalmic Barberry (*Eng.*), Vinettier tinctorial (*Fr.*).

Hab.—Western Himalaya from Garwhal to Hazara.

B. ASIATICA, *Roxb.*

Fig.—*Deless. Ic. Sel. ii., t.* 1.

Hab.—Himalaya, Behar on Parasnath. The stem, root-bark, extract and fruit.

Vernacular.—The stem, Dárhalad (*Hind., Bomb.*). The extract, Rusot, Raswanti (*Hind., Bomb.*), Raswal (*Sind.*). The fruit, Zarishk (*Pers., Hind., Bomb.*), Ambarbaris (*Arab.*).

History, Uses, &c.—Various species of Barberry occur on the Himalaya and Nilgiri mountains in India, at elevations between 6,000 and 10,000 feet. The wood (*Dáruharidrá*), extract (*Rasánjana*), and probably the fruit, have been used by the natives from a very early date. The Greeks were acquainted with the extract under the name of Indian Lycium as long ago as the first century; it would appear, though, that there were other kinds of Lycium in use at that time. (*Confer. Pharmacographia*, p. 34.*) The early Arabian writers were also acquainted with it by the name of Huziz-i-Hindi,† and mention its Indian name, which some of them derive from Ras, juice, and Uth (*uthna*, to boil). Hakím Abd-el-Hamid describes its manufacture from the powdered wood by exhaustion with water, filtration, and admixture with an equal bulk of cow's milk, the mixture being finally evaporated to the consistence of an extract, and enveloped in leaves; this method of preparation is the same as that described in Sanskrit works.

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* Dios. i. 117; Plin. 24, 76, 77; Cels. 5, 26; 6, 7; 8, 6; Scrib. Larg. Comp. 19, in the early stage of ophthalmia.

† They describe two kinds, *Maki* or the λύκιον of the Greeks, and *Hindi* or Indian; the former was derived from *Rhamnus infectorius*, the berries of which are used in dyeing leather yellow.

Royle, in 1833, brought Rusot more prominently to the notice of Europeans; since then it has been pretty extensively employed as a tonic and febrifuge. The root-bark of Barberry is now official in the Pharmacopœia of India, it is noticed in the Tuhfat-el-muminín under the name of Árghis, and is said to possess all the properties of Mámírán. Surgeon-General Cornish, of Madras, states that the Nilgiri Barberry bark (Mullu-kulla-puttai *Tam.*,) has been used in the treatment of ague with good results. A similar opinion appears to be generally held by medical men in India. In the bazaars the stem, extract and fruit are always obtainable; the two first are considered cold and dry, and are prescribed in combination with other bitters and aromatics, as tonics and antiperiodics, especially when bilious symptoms and diarrhœa are present; they are also used in menorrhagia. Rusot mixed with opium, alum, rock salt, chebulic myrobalans, and various other drugs, is much used as an external application in inflammatory swellings, and is rubbed in round the orbit in painful affections of the conjunctiva; it is also used mixed with honey as an application to aphthæ, and abrasions and ulcerations of the skin, and mixed with milk it is dropped into the eye in conjunctivitis. The fruit is cooling and acid. Berberine in doses of 1½ grain given subcutaneously kills rabbits, with symptoms of prostration and fall of temperature; but a dose eight times as great given to them by the mouth has no action, and 15 grains only produce in man slight colicky pains and diarrhœa. Is said to cause contraction of the intestines and of the spleen, and to lessen oxidation in the blood. (*Lauder Brunton.*) The drugs which contain this alkaloid are very useful in malarial dyspepsia accompanied by a febrile condition.

Description and Microscopic structure.—Dárhalad occurs in pieces, 1 to 2 inches in diameter, covered by a soft, corky, light brown bark; beneath this is a hard layer of stony cells, forming a complete coating to the stem; this layer is marked by longitudinal furrows corresponding to the medullary rays, which are very prominent and close-grained, and contain many stony cells; between the rays are wedge-shaped portions of

wood supplied with very large fenestrated vessels, and external to each wedge-shaped portion is situated a peculiar band of a pale yellow colour, which lies in contact with the stony envelope; there is a small close-grained central column, consisting of cells containing starch; all parts of the wood are impregnated with yellow colouring matter freely soluble in water.

Rusot is a dark brown extract of the consistence of opium, having a bitter and astringent taste, readily soluble in water, partly so in rectified spirit, forming a rich yellowish brown solution, which becomes bright yellow when diluted. It is prepared in Nipal and the Dhoon.. Zirishk is a moist sticky mass of small black fruit, rather larger than English Barberries; most of them are abortive, but a few contain one or two oblong seeds about 3-20ths of an inch in length, with a thin roughish brown testa, beneath which is a membranaceous covering; the perisperm is yellow, embryo nearly as long as the perisperm, yellow, erect; cotyledons oblong; radicle subcylindric, inferior.

The root bark is brittle, externally light brown and corky, beneath the suberous layer it is of a dark brown, with a greenish yellow tinge, fibrous, and very bitter.

Chemical composition.—The bitter principle of Barberry root and wood is berberine, which it contains in great abundance. The fruit contains tartaric and malic acids. Berberine or berberia was first discovered by Chevallier and Pelletan (1826) in the bark of *Zanthoxylum clava Herculis, Linn.*, and named *zanthopicrit*; its identity with berberine was proved by Perrins (1862). A. Buchner, who obtained it (1835) crystallized from barberry root, believed it to possess acid properties, and named it berberin. It had been previously separated in an impure condition by Brandes (1825) and by Buchner (1830). G. Kemp (1841) noticed that it forms crystallizable compounds with various mineral and organic acids, but its alkaloidal nature was first proved by Fleitmann (1846). Since then it has been discovered in numerous plants of the orders

Berberideæ, Ranunculaceæ, Menispermaceæ, &c. Its composition is $C^{20}\ H^{17}\ NO^{4}$. (*Perrins.*) Berberine dissolves in strong sulphuric acid with a dingy olive-green, and in nitric acid with a dark brown-red colour. Solutions of its salts are precipitated greenish-brown by potassium ferrocyanide, and yellow by picric acid, phosphomolybdic acid, or chloride of gold, platinum or mercury; the precipitates are mostly crystalline or crystallize readily; the phosphomolybdate dissolves in ammonia with a blue colour. Dissolved in hot alcohol, the salts of berberine yield, with solution of iodine in potassium iodide, dark-green scales of metallic lustre and appearing reddish-brown in transmitted light; if an excess of iodine be employed: the crystals are of a red-brown colour in reflected light. Hydrochlorate of berberine assumes with chlorine a blood-red colour. (*Buchner.*) This behaviour furnishes a delicate test, by means of which, according to Klunge, berberine may be detected in over 200,000 parts of solution; brucine, which gives a similar colour with chlorine, yields with acids colourless solutions. Fused with potassium hydrate, berberine is decomposed, yielding two acids, one of which is sublimable, the vapours having the odour of chinolin. (*Hlasiwetz and Gilm.*) Oxyacanthine, $C^{32}\ H^{46}\ N^{2}\ O^{11}$, remains in the mother liquor from which the berberine salt has been precipitated by an acid. It is a white alkaloid, turning yellow in sun-light, nearly insoluble in water, and has a bitter taste and alkaline reaction; it is soluble in alcohol, less so in ether, but freely in chloroform, benzol, fats and volatile oils. Sulphuric acid colours it brown-red. Nitric acid imparts a yellow and, when heated, a purple colour. Berbamine $C^{18}\ N^{19}\ O^{3}\ N$ and at least another alkaloid are also contained in the root. (*Cf. Stillé and Maisch. Nat. Disp., 3rd Ed., p.* 315, *On Berberine, by W. H. Perkin, jun., Journ. Chem. Soc., Feb.* 1889.)

Commerce.—Dárhalad comes to the plains from Northern India and from the Madras Presidency. Rusot and Zirishk from Northern India. Value, Dárhalad, Rs. 3½; Rusot, Rs. 8-9 per maund of 37½ lbs.; Zirishk, Re. ¼ per lb.

PODOPHYLLUM EMODI, *Wall.*

Fig.—*Jacq. Voy. Bot. ii.*, t. 9.

Hab.—Interior ranges of the Himalaya, Sikkim, Hazara, Cashmere.

Vernacular,—Pápra *or* Pápri, Bhavan-bakra *or* bakra, Chimyaka (*Hind.*).

History, Uses, &c.—The genus Podophyllum contains four known species, one Himalayan, one American and two Chinese. The Indian species inhabits shady valleys in the inner ranges of the Himalaya, and is very abundant in Kunawur and Cashmere. The remarkable appearance of its bright red fruit would lead one to suppose that it must have attracted the attention of the Hindus, and judging by the Hindi names *Pápra* and *Bhavan-bakra* it is probable that it was one of the bile-expelling plants, described by Sanskrit writers under the names of *Parpata* and its synonym *Vakra*. In Hindi the Sanskrit *parpata* becomes *pápra* and *vakra* changes into *bakra*; the prefix *bhavan* probably means "hill" and the Hindi name would thus signify "hill vakra" as distinguished from *kshetra-vakra* or *kshetra-parpata*, field vakra or parpata, a name applied to one or more species of Oldenlandia. The modern medical literature of India contains hardly any information about this plant. A specimen of the root was forwarded to the Committee for investigating Bengal drugs, by Dr. Falconer about fifty years ago, but no examination of it appears to have been made. The plant is mentioned in the Pharmacopœia of India as a possible source of Podophyllin, and Stewart says that the fruit is used medicinally in Lahoul.

Description.—Stem or scape 6 to 12 inches, erect, stout, herbaceous; leaves 2, vernal, alternate, long-petioled, plaited and deflexed in vernation, 6 to 10 inches in diameter, orbicular, 3 to 5 lobed to the middle or base; lobes cuneate, acutely serrate; peduncle terminal in bud, then apparently supra-axillary or inserted on the petiole of the upper leaf; flowers 1 to

1½ inch in diameter; sepals very deciduous; petals 6, sometimes 4 (*Royle*), obovate-oblong; berry 1 to 2 inches long, ellipsoid, red. (*Fl. Br. Ind.*) The root agrees with that of *P. peltatum* in most particulars, but differs in the intervals of the knots whence the aerial stems are given off. The rhizome is more or less cylindrical, crowded above with tuberosities, marked by depressed oval or circular scars, and giving off numerous simple rootlets below. The terminal bud is enclosed in whitish papery sheaths. The colour is yellowish-brown, paler in the rootlets. The fracture is short and mealy, disclosing a white section, with a circular arrangement of yellow vascular bundles, and bounded on the outside by a thin brown cortical layer.

Chemical composition.—The powdered root was macerated in rectified spirit for four days, and the tincture evaporated to dryness, weighed 25 per cent. of the drug. This extract was well washed with water, which removed sugar and bitter colouring matter to the extent of 15 per cent. The remaining 10 per cent. of resin or resins was dried at a low temperature and had a bright brownish yellow colour. The reactions of the resin with tests, and its solubility in chloroform, ether, and diluted alkalies were very similar to those of the official resin of *P. peltatum*.

Half a grain (·035 grm.) taken in the evening produced unmistakably a cathartic action the first thing next morning. A slight griping was experienced.

NYMPHÆACEÆ.

NELUMBIUM SPECIOSUM, *Wight.*

Fig.—*Wight, Ill. i., t.* 9; *Bot. Mag., t.* 903; *Rheede, Hort. Mal. xi.,* 30, 31. Egyptian Lotus (*Eng.*), Nélumbium magnifique (*Fr.*).

Hab.—India, Persia, Ceylon, Siam, Cochin-China, Philippines, Moluccas, China and Japan. The flowers.

Vernacular.—Kamal, Kanval (*Hind.*), Alli-támara (*Tel.*), Nyadale-huvu (*Can.*), Kamala (*Mar.*), Sevaka (*Goa.*), Paban (*Sind.*), Ambal (*Tam.*).

History, Uses, &c.—This is a classical plant amongst the Hindus and Egyptians. The world at its creation is likened to a Lotus flower floating on water. Om! mani.padme. Om! the pearl of creation is in the Lotus. It is emblematic of the heavens, Brahma is supposed to reside on a Lotus flower in a sea of milk, and to sleep six months of the year, and watch the other six months; an allusion to the seasons in which Brahma represents the Sun. Mr. O. C. Dutt, in his Hindu Materia Medica, speaks thus of it:—"These beautiful plants have attracted the attention of the ancient Hindus from a very remote period, and have obtained a place in their religious ceremonies and mythological fables; hence they are described in great detail by Sanskrit writers. The flowers of *N. speciosum*, called *Padma* or *Kamala*, are sacred to Lakshmi, the goddess of wealth and prosperity. The white variety of this plant is called *Pundarika*, the red *Kokanada*, and the blue *Indivara*. The entire plant, including root, stem and flowers, is called *Padmini*. The torus or receptacle for the seed is called *Karmikara*, and the honey formed in the flowers *Makaranda*. The filaments round the base of the receptacle pass by the name of *Kinjalka*, and the leaf stalk by that of *Mrinala*." *N. speciosum* is the κυαμος ἀιγύπτιος of Theophrastus. The Arabians and Persians, under the name of *Nilufer*, which, they say, is a corruption of an Indian name, and derived from Nila, water, and Phala, fruit, describe the several varieties of Nelumbium and Nymphæa, and do not appear to consider the flowers of the former plant in any way superior to the latter. They direct the white and blue kinds to be preferred. Both Hindus and Mahometans consider the flowers to be especially cooling and astringent, and consequently prescribe them in a variety of disorders which are supposed to proceed from heated humours, such as sanguineous fluxes from the bowels, &c.; they are given in decoction with liquorice or in the form of a syrup

containing ½ a part of the dried flowers, 1 part sugar, and 5 parts water, dose 2 to 3 drachms. A powder is also used. As an externally cooling application Lotus flowers are made into a paste with sandalwood or emblic myrobalans.

The seeds of *N. speciosum*(Kamal kakrí),* and of *Euryale ferox* (Makhána) are used as articles of diet. In times of scarcity the roots and scapes (bishi) of *N. speciosum* are also made use of, but they are bitter and unpalatable. The starch contained in the thick rhizome, separated by rasping and washing, constitutes a sort of arrowroot used by the Chinese, under the name of *Gaan-feen*. (*D. Hanbury*.)

Description.—The calyx consists of four to five deciduous sepals; the corolla of numerous deciduous petals, arranged in several rows; the stamens are numerous, in several rows, attached with the petals to the base of the receptacle; the stigma is sessile; the dry flowers have a brown colour; the seeds are black and like small acorns.

Chemical composition.—The rhizome of *Nymphæa alba* contains an alkaloid which appears to be identical with that obtained from *Nuphar luteum* in its chemical and physical properties, as well as in its behaviour towards group re-agents, but in their colour reactions there is a decided difference; inasmuch as the alkaloid of Nymphæa does not give the green reaction with dilute sulphuric acid which *nupharine* does, and gives the following reactions which are not given by that alkaloid. Concentrated sulphuric acid and potassium chromate colour its solution first red-brown and after some hours clear green; concentrated sulphuric acid alone produces a red brown which passes into grey. Frohde's re-agent colours it first red, then dirty-green. The alkaloid is not present in the blossoms or seeds, it is tasteless, but its acid solution is intensely bitter. The formula is $N^2 C^{18} H^{24} O^2$, the same as that given by Pelletier and Couerbe to menispermine and paramenispermine, and the three alkaloids are probably isomeric.

* Bákla-i-kubti or Bákla-i-nabti of Persian writers (Coptic bean).

The tannins of Nymphæa are notable for yielding many secondary products, which have been individually found in other tannins, but their presence together has not been hitherto noted. Ellagic and gallic acids are easily obtained; another substance, which rapidly absorbs oxygen from the air, and passes into a body of the nature of phlobaphene; and a second substance, which by similar absorption of oxygen passes into two bodies, or assumes two phases with properties similar to chlorophyll.

The rhizome and seeds of Nymphæa also contain resins, glucose, metarabin and fat, besides other substances common to plants. (*W. Grüning, Archiv. der Pharm.* [3], XX., 582—605 and 736—761; *Pharm. Journ.* [3], XIV., 49.)

Commerce.—The seeds are imported from Persia in large quantities as an article of diet. The fresh flowers are brought to market in August for use in the temples. The dried flowers sold in shops as Kamal are generally those of Nymphæa.

PAPAVERACEÆ.

PAPAVER SOMNIFERUM, *Linn.*

Fig.—*Eng. Bot.* 2145; *Bentl. and Trim., t.* 18. Garden Poppy (*Eng.*), Pavot somnifére (*Fr.*).

Hab.—Cultivated in India. The juice, capsules, petals and seeds.

Vernacular.—*Opium,* Afiyún, Afím (*Hind.*), Aphím, Appo (*Bomb.*), Abini (*Tam.*). *Poppy seed,* Kashkásh (*Hind.*), Khaskhas (*Bomb.*), Gashagasha (*Tam.*). *The capsules,* Post (*Hind., Bomb.*), Postaka-tol (*Tam.*).

History, Uses, &c.—Opium is not mentioned by the older Hindu writers; in works of later date it is named in Sanskrit Ahiphena. If we trace the history of the drug, we

find that it was known to the Greeks in the beginning of the third century, B. C., and was probably first collected and prepared in Asia Minor. The Arabians next became acquainted with it, and converted the Greek name Opion into Afiyún; some of their writers mention this derivation, and say that the Greek word means soporific.* It is generally supposed that the Persians and Indians became acquainted with opium through the Arabians; but some Persian writers suppose that the Tiryák which Rustum obtained from Kaikáous to give to Sohráb was opium. For a further account of the history of the drug, the Pharmacographia and other standard works on Materia Medica may be consulted. The poppy generally cultivated in India is the *P. somniferum* var. *album*, with white flowers and white seeds: but a red-flowered and black-seeded variety is met with in the Himálayas. The principal opium-producing region of British India lies in the central tract of the Ganges, bounded by Dinajpur in the east, Hazaribagh in the south, Gorakhpur in the north, and Agra in the west, thus including the districts of Behar and Benares. In 1886-87, 919,852 bighas of land were under poppy cultivation in those districts. The next important opium-producing region embraces the table lands of Malwa, and the slopes of the Vindhya Hills: it is stated that the variety grown there is the *P. glabrum*. The poppy is also grown, but to a smaller extent, throughout the plains of the Punjab, but less commonly in the N.-W. Provinces. In the valley of the Beas, east of Lahore, it is cultivated up to an altitude of nearly 7,500 feet. Most of the outer districts grow poppy to a certain extent, and produce opium for local use. But the drug prepared in the Hill State and in Kulu, forms a staple article of trade for that region. Opium is also produced in Nipal, Baisahir and Rampur, and at Doda Kashtivar, in the Jammu territory: in the Nundidrug district in Mysore, in the Baldasuch district of West Berar, and in Assam.

* *οπιον.* Latin, Opium or Opion. Plin. 20, 76. Poppy juice The Arabian lexicographers regard the word as Arabic, the author of the Kámús derives it from the root فين, others from افن.

The revenue derived by Government from the opium monopoly is obtained by two principal means, by allowing the drug to be manufactured by licensed cultivators in the Patna and Benares districts, the opium being purchased by Government at a fixed rate; and, secondly, by the impost of a heavy duty on opium manufactured in native States, but brought in transit to a British port for exportation. The former system obtains in Bengal, the latter in Bombay The number of licensed cultivators in Bengal always exceeds a million.

The opium industry in Bengal is thus completely under the control and monopoly of Government, and the districts producing the drug are divided between two agencies—one for Bihar, and having its head-quarters at Patna, the other for Benares, at Ghazipore. The opium prepared in the Benares Agency is for the greater part taken by the cultivators to sub-factories (*Kothis*), of which there are several in each district, where the drug is weighed and examined, and finally consigned in bulk to the head factory at Ghazipore. The opium prepared, however, in the home divisions, near the head factory, is taken by the cultivators direct to Ghazipore. The receipt of opium at the head factory is thus conducted under two systems, the first described being termed Challán, and the second Assamiwar. In the Bihar Agency the whole of the opium received at the head factory is Challán.

The lands selected for poppy cultivation are usually in the vicinity of villages. The early sowings are made about the middle of November, and the second and third by the end of December. The seeds germinate in 10 to 12 days. In the Benares district, in some instances in January, but generally in February and March, the plants are mature, and the capsules fit for scarification. The capsules then become slightly coated over with a fine transparent white bloom, and are less yielding to the touch when pressed. Another method of recognising maturity, is when juice exudes on breaking off the series of stigmata formed on the apex of the capsule. When the plant is in full flower, and just before the time for the fall of the

petals, they are collected in the following manner. The forefinger and thumb encircle the stem just beneath the capsule, and with the other fingers drawn inwards a kind of tube is formed: the fingers are then gently raised straight over the capsule, and if the petals are matured, they come off. They are never plucked off, as it would injure the capsule. The petals are manufactured into what are technically called *leaves*. A circular ridged earthen plate, about 10 to 14 inches in diameter, is placed over a low fire, some petals are then spread on the heated convex surface, and as soon as their glutinous juice exudes, others are added, and pressed with a damp cloth pad, till they have adhered together. The leaf is then removed and allowed to dry. "Leaves" vary in diameter from 6 to 12 inches, and in thickness from ·3 to ·025 inches.

A few days after removing the petals the capsules are incised. The operation takes place in the afternoon, and is performed by bunches of forked blades (*nashtars*). The blades are bound together with cotton thread, which is at the same time passed between the blades so as to separate the cutting-ends by about $\frac{1}{16}$ inch, while the protrusion of the points is limited to about $\frac{1}{12}$ inch, which thus determines the depth of the incision. The incisions are made vertically* from base to summit, usually along the eminences of the capsule, marking the attachment of the internal dissepiments and penetrating the epicarp and sarcocarp. The number of incisions required to complete the exudation of all the juice varies with size of capsule, from 2 to 6 or even 8; and two to three days are allowed to alternate. A milky juice exudes almost immediately after scarification; the water it contains evaporates slowly, and the outer portion of the tear drying somewhat, thickens a little and acquires a rose-red colour, while the inner portion is semi-fluid and of a pinkish tinge. The collection of the exuded juice takes place early on the morning following the scarification. In Bengal it is performed by a small sheet iron scoop (*sutwa*, सुतवा), which is

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* In some parts of Bengal horizontal incisions are adopted as in Asia Minor. In Mysore thorns are used for scratching the capsules.

twice drawn briskly upwards over each incision, and a finger run over the incisions to close them. The opium thus collected is from time to time emptied into an earthen or brass vessel.

The fresh opium as collected contains about 50 per cent. of moisture. The average quantity yielded per scarification is perhaps 10 grains, while a single healthy plant under favourable circumstances yields about 75 grains opium in from 5 to 8 scarifications. The average yield of opium per bigha obviously varies from year to year. In 1886-87, the average produce in Benares was 5 seers 3 chittacks and 2 katchas and in Bihar 4 seers 5¼ chittacks.

When the vessel containing recently collected semi-fluid opium is tilted and allowed to remain for some time in that position, a blackish fluid having a peculiar odour separates: this is termed *pasewha* (पसेवहा). *Pasewha* is not always found in opium; it is only produced under peculiar atmospheric conditions. It is never present when a strong westerly wind blows, or when no dew is deposited. The yield of opium under these circumstances is small owing to the incision in the capsule being quickly sealed up by the juice, which rapidly concretes, and is entirely free from *pasewha*. Where the deposition of dew on the other hand is considerable, *pasewha* is formed. The *pasewha* present in opium is carefully separated; if allowed to remain, the opium is injured in colour, texture, and aroma, and it becomes unsuited for the China market, although the drug is perfectly pure. Opium containing any amount of *pasewha* is subject to "penalty batta," which consists in a deduction of from $\frac{1}{64}$th to $\frac{5}{64}$ths of the value of the whole weight of opium tendered by the cultivator.

The opium freed partially or completely from *pasewha* is exposed to the air in the shade, and turned occasionally so as not to injure the grain, until it reaches approximately the required consistency, when it is taken to the head or one of the sub-factories, as already described.

The stems and leaves of the poppies are left standing after removal of the capsules, till perfectly dried by the hot winds,

when they are collected and crushed into a coarse powder, termed *trash*, employed for packing opium for the China market.

The opium, as received from the cultivators at the sub-factories, varies in consistence, and is divided into six classes, while the final classification of the drug is determined at the head factory, where the opium is finally classified in 12 classes. The classification of the drug depends upon the percentage of solid opium present when a sample is dried at 200° F. Thus opium containing 20 per cent. of moisture would be termed opium of 80 degrees consistence. In the classification of opium each class of opium has a range of three degrees. The opium received into the factory may vary in consistence from 81 degrees and upwards to 50 degrees or less, all opium containing only 50 per cent. and under of solid opium being included in one class, called "*Páni-ámez*," while opium above 81 degrees is designated "above *Bála-báshi dar awal*." The assay of opium for moisture is performed by placing 100 grains on a plate, which is placed on a steam table, the opium being constantly rubbed with a spatula till it is reduced to powder. The temperature to which the opium is exposed does not exceed 200° F.

The opium received into the head factory is, after careful examination for adulteration, and assay for moisture, placed in large stone vats, according to the class to which it belongs. The classification of opium is of considerable consequence, because Benares and the Bihar Factory have each to prepare opium for the China market of a fixed consistence, the standard for Bihar being 75 degrees and for Benares 70 degrees consistence: and it is by the admixture of opium of various degrees of consistence that these standards are maintained. Although the standards for the two districts are fixed, a latitude of ·5 of a degree above or below the standard is permitted, as it is practically impossible to exactly hit off the exact standard when manipulating such large quantities of the drug—nearly three tons—as are daily required for caking. In very dry seasons, the opium being of high consistence, a portion may have to

be caked one or more degrees above standard, but under such circumstances the standard weight of opium 1 seer 7½ chittacks must be placed in each cake, no reduction in weight being allowed for increase in consistence. Taking the Benares Agency for example, where the daily manufacture of cakes amount to about 20,000, to cake at one degree above the limit would entail a loss to Government of Rs. 1,260 a day.

The opium received into the head factories is employed for the manufacture of China provision, abkari, and medicinal opium, while at Ghazipur certain varieties are used for the extraction of alkaloids.

To prepare opium for the China market a certain number of vats are selected, and samples assayed for moisture. The contents of those vats which will give when mixed together in certain proportions opium of 69·3 or 69·4 degrees for Benares, are equally distributed over other vats, called alligation vats, the opium is well mixed by men walking about in it and kneading it with their feet and with rakes. The opium is then removed to the caking vats, and is again kneaded on the following morning, when samples from each vat are assayed; should the whole of the assays come out above 69·5° and under 70·50°, the opium is ready for caking.

The manufacture for the China market consists in enveloping a portion of standard opium in leaves agglutinated by a mixture of opium and water called *lewa* (लेवा). *Lewa* consists of dirty but otherwise pure opium broken down in water in which the opium vessels have been washed, and which is technically called *dhoi* (धोई), about 8 per cent. of *pasewha* being added to render the *lewa* glutinous. *Lewa* contains from 52·5 to 53·5 per cent. of solid matter. The opium, leaves, and *lewa* are accurately weighed for each cake.* The finished cake resembles a Dutch cheese in size and shape; it is rolled in a little fine *trash*

* At Benares the following materials are used for making a cake:—Standard opium at 70 degrees, 1 seer 7·5 chittacks; Lewa at 53°, 4·5 chittacks; Leaves, ·5 chittacks; Water, ·5 chittacks; *Trash*, ·25 chittacks—Total weight on day of manufacture, 2 seers 1·75 chittacks.

and placed in an earthen cup of the same size as the mould in which it was originally made, and exposed to the sun; this exposure is continued for two or three days, the cakes being constantly turned and carefully examined. One man assisted by a child will turn out about 70 cakes in four hours, though some can turn out 90 to 100. After having dried the cakes partially by exposure to the sun, they are removed, still in thin earthen cups, to the cake godowns, where they are kept on racks, and constantly turned and rubbed with dry *trash*. In September the cakes are finished at the Benares Factory by placing a fine *Chandni* leaf* on each, weighing ·43 of a chittack with ·5 of a chittack of *lewa*. At this period all bulged and grub-eaten shells, &c., are repaired. By October† they are dry to the touch, and are packed in chests, furnished with a double tier of wooden partitions, each tier with twenty square compartments for the reception of as many cakes, the cakes being steadied and lightly packed round with *trash*. All the joins in the box are secured by cloth and pitch, and a cover of coarse canvas sewn on.‡

Abkari opium is the opium prepared for local consumption; it is pure opium dried by exposure to the sun in shallow wooden trays, with constant stirring, until its consistence is 90°; it is then accurately weighed into quantities of one seer, which are pressed into square blocks; the blocks are wrapped, in Nipal paper, slightly oiled with poppy oil, and packed in boxes containing 60 cakes.

Medicinal opium is pure opium of good colour and aroma, and free from *pasewha*. It is reduced to powder by being placed on plates which are heated on a steam table, and the

* A person accustomed to handle Indian opium can, by the appearance imparted to a Benares cake by this last leaf, distinguish it from a Patna one.

† Theoretical weight of a Benares cake fit for packing: Standard opium in cake at 70°, 1 seer 7·5 chittacks; Opium in *lewa*, 3·75 chittacks; Leaves, 5·43 chittacks; Fine *trash*, ·5 chittacks.

‡ A packed chest of Benares opium weighs 3 maunds 26 seers 1 chittack, and contains 40 cakes, weighing on the average 2 maunds 8 chittacks.

opium constantly rubbed with a steel spatula till a dry powder is obtained.

*Adulteration of Opium.**—The articles used by the cultivator for adulterating opium may be classified as follows :—

1. Adulteration with fresh green parts of the poppy plant, including watery extracts.

2. Adulteration with foreign extractives, and vegetable matter, such as the inspissated juice of the *Opuntia Dillenii* and *Calotropis gigantea*, extracts of the tobacco plant, datura and hemp.

3. Gums and resinous matters. A gum resin derived from different varieties of *Ficus*, and called *Lassa*. The resin of *Shorea robusta* (sál), pulp of Bael fruit, gum from seeds of Talimkhana (*Hygrophylla spinosa*), tamarind pulp, gum from *Acacia arabica*.

4. Farinaceous admixtures, including linseed, poppy seed, seeds of leguminous plants, and esculent tubers and roots. The starchy matter is often heated for a long time before being used; hence iodine reaction may fail.

5. Vegetable substances containing tannin and colouring matters. Catechu, "Gáb" (*Diospyros embryopteris*, juice of fruit), turmeric, flowers of *Bassia latifolia*, betel-nut, extract of pomegranate bark.

6. Saccharine matter; vegetable oils and ghee; soot, charcoal, and semi-burnt opium; cotton and paper; cowdung; earthy and siliceous matter; pounded burnt bricks; impure carbonate of soda, &c.

Opium found to be seriously adulterated may be confiscated, or a fine can be levied. At the Benares Agency, during 1868-69, the gross receipt of opium of all kinds amounted to 39,893 maunds, out of which fines were levied on 181 maunds, as being "inferior opium," and on 71 maunds on account of

* **Memorandum by the late Surgeon-Major Sheppard, Principal Assistant Opium Agent, Benares.**

pasewha, while 34 maunds were confiscated owing to serious adulteration.

MANUFACTURE OF ALKALOIDS.*—The opium used at Ghazipore for manufacture of alkaloids, consists of confiscated opium so adulterated as to be unfit for provision or abkari purposes; adulterated contraband opium and *dhoi*. The average amount of opium used, taking the figures for three years from 1886 to 1888, amounts to about 16,626 lbs. annually.

The yield of alkaloids during 1887-88 was as follows:—

Hydrochlorate of Morphia...	242 lbs.	14½ oz.
Acetate „ „ ...	34 „	11 „
Sulphate „ „	19 „	10½ „
Codeine	30 „	10¼ „

No narcotine has been manufactured since 1881-82, there being no demand for it. In 1879-80, the yield was 188 lbs.

Morphia is manufactured by the Gregory-Robertson system modified in a few minor details. The opium is steeped in small vats with water, and the liquor passed through blanket filters: the maceration of the residue is repeated until the filtrate is colourless. The mixed filtrates are evaporated by steam to a thin syrupy consistence. Chloride of calcium is then added in the proportion of about 5 per cent. of the weight of the opium used, and the mixture evaporated until it solidifies on cooling. The crystalline magma is then powerfully pressed. The dry cake is dissolved in boiling distilled water, filtered, and the filtrate evaporated until it solidifies on cooling. Pressure is again applied to the magma; and the resulting cake again dissolved in water, and this process is repeated perhaps a dozen times, until the cake is almost white. The expressed mother liquors are again worked up for morphia. The nearly white cake is finally dissolved in boiling distilled water, and ammonia in slight excess added. The precipitate is

* Mr. Gregory, Offg. Principal Assistant Opium Agent, Benares, has kindly furnished the information regarding the manufacture, &c., of alkaloids as conducted at Ghazipore.

collected and worked with cold distilled water, until it ceases to give the reaction for chlorides. The precipitated morphia is then neutralized with hydrochloric acid, and the solution crystallised. The crystals are pressed, and mixed with twice their weight of water, and wood charcoal* added in the proportion of 2 oz. to each lb. of the mass. This mixture is heated to 200° F. for about twenty minutes, and then filtered. On cooling the hydrochlorate of morphia separates in crystals. Codeia is obtained from the mother liquor left after the precipitation of the morphia by ammonia. The liquor is concentrated to a moist mass and strongly pressed; the cake is moistened with water and again pressed, and this is repeated until the alkaloid is nearly white. The cake is broken up in water, and caustic potash added in considerable excess. The codeia separates in crystals slightly coloured. It is finally purified by crystallisation from alcohol. Narcotine is obtained by digesting with hydrochloric acid the insoluble residue left by the action of water on opium, and precipitating with ammonia. The impure narcotine is purified by repeated solution and crystallisation from alcohol, and decolorised by charcoal.

The opium used in Western India is known as Malwa; it is collected in the province of that name, and, besides supplying local markets, is largely exported to China. The following account of the cultivation of the Poppy in Malwa is given by Dr. Impey, who resided there for three years:—"For the successful cultivation of opium, a mild climate, plentiful irrigation, a rich soil, and diligent husbandry, are indispensable. In reference to the first of these, Malwa is placed most favourably. The country is, in general, from 1,300 to 2,000 feet above the level of the sea; the mean temperature is moderate, and range of the thermometer small. Opium is always cultivated in ground near a tank or running stream,

* Charcoal from the *Butea frondosa* is used; it was selected on account of its comparative freedom from saline matter. Though wood charcoal possesses feebler decolorizing power than animal, it had to be used on account of native prejudice against animal charcoal.

so as to be insured at all times of an abundant supply of water. The rich black loam supposed to be produced by the decomposition of trap, and known by the name of cotton soil, is preferred for opium; though fertile and rich enough to produce thirty successive crops of wheat without fallowing, it is not sufficiently rich for the growth of the poppy until well manured; there is, in fact, no crop known to the agriculturist, unless sugar-cane, that requires so much care and labour as the poppy. The ground is first four times ploughed on four successive days, then carefully harrowed, when manure, at the rate of from eight to ten cart-loads an acre, is applied to it; this is scarcely half what is allowed to a turnip crop in Britain. The crop is after this watered once every eight or ten days, the total number of waterings never exceeding nine in all. One bigha takes two days to soak thoroughly in the cold weather, and four as the hot season approaches. Water applied after the petals drop from the flower causes the whole to wither and decay. When the plants are six inches high, they are weeded and thinned, leaving about a foot and a half betwixt each plant; in three months they reach maturity, and are then about four feet in height if well cultivated. The full-grown seed-pod measures three and a half inches vertically, and two and a half in horizontal diameter. Early in February and March the bleeding process commences. Three small lancet-shaped pieces of iron are bound together with cotton, about one-twelfth of an inch alone protruding, so that no discretion as to the depth of the wound to be inflicted shall be left to the operator; and this is drawn sharply up from the top of the stalk at the base to the summit of the pod. Three sets of people are so arranged, that each plant is bled all over once every three or four days, the bleedings being three or four times repeated on each plant. This operation always begins to be performed about three or four o'clock in the afternoon, the hottest part of the day. The juice appears almost immediately on the wound being inflicted, in the shape of a thick, gummy milk, which is soon thickly covered with a brown pellicle. The exudation is greatest over-night, when the incisions are washed and kept

open by the dew. The opium thus derived is scraped off next morning with a blunt iron tool resembling a cleaver in miniature. Here the work of adulteration begins—the scraper being passed heavily over the seed-pod, so as to carry with it a considerable portion of the beard, or pubescence, which contaminates the drug and increases its apparent quantity. The work of scraping begins at dawn, and must be continued till ten o'clock; during this time a workman will collect 7 or 8 ounces of what is called 'chick.'* The drug is next thrown into an earthen vessel, and covered over or drowned in linseed oil at the rate of two parts of oil to one of chick, so as to prevent evaporation. This is the second process of adulteration, the ryot desiring to sell the drug as much drenched with oil as possible, the retailers at the same time refusing to purchase that which is thinner than half-dried glue. One acre of well culivated ground will yield from 70 to 100 pounds of chick. The price of chick varies from 3 to six rupees a pound, so that an acre will yield from 200 to 600 rupees' worth of opium at one crop. Three pounds of chick will produce about two pounds of opium, from the third to the fifth of the weight being lost in evaporation. It now passes into the hands of the Bunneah, who prepares it and brings it to market. From 25 to 50 pounds having been collected is tied up in parcels in double bags of sheeting cloth, which are suspended from the ceiling so as to avoid air and light, while the spare linseed oil is allowed to drop through. This operation is completed in a week or ten days, but the bags are allowed to remain for a month or six weeks, during which period the last of the oil which can be separated comes away, the rest probably absorbs oxygen and becomes thicker, as in paint. This process occupies from April to June or July, when the rains begin. The bags are next taken down, and their contents carefully emptied into large vats from 10 to 15 feet in diameter and six or eight inches deep. Here it is mixed together and worked up with

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* चिक *chick*, a common term in Western India for the sticky juice of any plant.

the hands 5 to 6 hours, until it has acquired an uniform colour and consistence throughout, and become tough and capable of being formed into masses. This process is peculiar to Malwa. It is now made up into balls of from 8 to 10 ounces each, these being thrown, as formed, into a basket full of the chaff of the seed pods. It is next spread on ground previously covered with leaves and stalks of the poppy; here it remains for a week or so, when it is turned over and left to consolidate, until hard enough to bear packing; it is ready for weighing in October or November, and is then sent to market. It is next packed in chests of 150 cakes, the total cost of the manufacture at the place of production being about rupees 14 per chest." The greater part of the opium produced in Malwa is consumed by opium-eaters. Besides linseed oil Malwa opium is often adulterated with starch, and inferior samples with some of the substances already mentioned as used to adulterate opium in Bengal.

Description.—China investment or provision opium varies in colour according to the amount of *pasewha* (पसेवहा) present, and the district from which it has been obtained. The colour may vary from dark brown to rich dark chestnut; when viewed in thin layers, it is translucent; odour rich, agreeable, and somewhat fruity; taste hot and bitter. If a small portion be rubbed between the finger and thumb for a few seconds, it draws out into long threads, and from their number, fineness, and tenacity, the Chinese form their first estimate of the value of the drug. The Abkari opium, in square cakes, has a very much darker colour and less pleasant odour than provision opium, its consistence is also greater, and it can with some little difficulty be moulded between the fingers. The medicinal opium occurs as a chocolate coloured finely granular powder.

Malwa opium occurs in round or slightly flattened balls, weighing about ten ounces each, and covered externally with some of the chaff from the capsules; its consistence is about the same as that of average Smyrna opium; appearance of section homogeneous; colour dark brown; odour like that of

Smyrna opium. Poppy capsules as found in Indian commerce are much broken, and appear to have been beaten to extract the seeds, the fragments are marked by triple or quadruple incisions, usually longitudinal, but sometimes transverse. The seeds are reniform, very small, usually white, but sometimes grey, a little over one millimetre long. The testa is composed of six-sided scale-like cells, the albumen is oily, and encloses a curved embryo composed of two cotyledons and a radicle of equal length; the taste is sweet and oily.

Poppy oil is of a pale golden colour, inodorous, of agreeable flavour and soluble in 25 parts of cold and 6 of boiling alcohol. Its chemical constitution is similar to linseed oil; saponification equivalent 290. Its specific gravity is ·924 to ·927 at 15·5 C.; it solidifies at —18° C.; does not easily become rancid; the oil is present in the seeds to the extent of about 50 per cent., but by the native process much less than this is extracted, the yield under favourable circumstances amounting to about 14 ozs. from 4 lbs. of seed. It is used as a substitute for olive oil by the Military Medical Establishments, but being a drying oil it is not nearly so well suited for medicinal use as the oil of *Arachis hypogæa.* It is also used to adulterate olive oil.

Microscopic structure—Opium of good quality, macerated in glycerine, shows numerous prismatic crystals, some of them in tufted bundles; a few large, refractive globular bodies are seen which have a resinous appearance, and here and there objects which appear to be starch grains; the remainder consists chiefly of amorphous particles, but mixed with them are some fragments of vegetable tissue (epidermis and fibre from the capsules). Of eight kinds of Indian opium examined by Flückiger five contained distinct crystals, two are described as not distinctly crystalline, and of one it is not stated whether it was crystalline or not. His sample of Malwa opium must have been of inferior quality, as the best shows numerous crystals.

Chemical composition.—The alkaloids which have been separated from opium are Hydrocotarnine, $C^{12}H^{15}NO^{3}$;

Morphine, $C^{17} H^{19} NO^3$; Pseudomorphine, $C^{17} H^{19} NO^4$; Codeine, $C^{18} H^{21} NO^3$; Thebaine, $C^{19} H^{21} NO^3$; Protopine, $C^{20} H^{19} NO^5$; Laudanine, $C^{20} H^{25} NO^4$; Codamine, $C^{20} H^{25} NO^4$; Papaverine, $C^{20} H^{21} NO^4$; Rhœadine, $C^{21} H^{21} NO^6$; Opianine, $C^{21} H^{21} NO^7$; Meconidine, $C^{21} H^{23} NO^4$; Cryptopine, $C^{21} H^{23} NO^5$; Laudanosine, $C^{21} H^{27} NO^4$; Narcotine, $C^{22} H^{23} NO^7$; Lanthopine, $C^{23} H^{25} NO^4$; Narceine, $C^{23} H^{29} NO^9$; Gnoscopine, $C^{34} H^{36} N^2 O^{11}$. A bitter principle, Meconin, $C^{10} H^{10} O^4$, is also present in opium, accompanied by Meconic acid, $C^7 H^4 O^7$.

Porphyroxin, first described by Merck, occurs in East Indian, in Smyrna, and probably other opiums. The principle is of interest, because it has the property of being reddened by hydrochloric acid, a reaction which has been utilized for many years in testing for opium in medico-legal analysis in the Bengal Chemical Examiner's Department. In testing viscera for opium the ethereal extract obtained by Stas's process is evaporated in a porcelain capsule, and the dry residue moistened with dilute hydrochloric acid; on the application of a gentle heat a red coloration is developed should opium be present. A good plan of applying the test is to place on the bottom of the capsule containing the dry ether extract, a very small watch glass moistened with a few drops of concentrated hydrochloric acid, the capsule is then covered with a glass plate; after standing some time a red or violet reddish coloration appears on the sides of the capsule should porphyroxin be present. The application of heat is unnecessary when the test is applied in this manner.* The chemical composition of porphyroxin appears to be a matter of some uncertainty; according to O. Hesse it is a mixture of several distinct principles. Pedler and Warden isolated in 1886 from Bengal opium a neutral principle insoluble in water, but dissolving in ether, chloroform, benzol, &c., and yielding solutions which exhibited a magnificent blue fluorescence. The morphine in opium is combined with meconic

* It is necessary to note that this test is only employed as a corroborative one for the presence of opium.

acid. The nature of these two substances was made known by Sertürner in 1816, who at the same time pointed out the difference between morphia and narcotine, a substance which had been discovered in opium by Derosne in 1803 and also by Séguin. There can be no doubt that these two chemists also obtained morphine, but failed to distinguish it from narcotine. Warden (*Chem. News*, 38, 146,) has examined the ash of Behar opium. It was of a light grey colour and contained ·857 per cent. of charcoal, which was deducted before calculating the percentage composition, which is as follows:—Fe^2O^3, 1·983; Ca O. 7·134; Mg O, 2·310; K^2O, 37·240; Na^2O, 1·700; SO^3 23·141; P^2O^5, 10·902; Si O^2, 15·274. There were also traces of alumina, manganese, carbon dioxide and chlorine present.

The examinations of various kinds of Indian opium conducted by Dr. Buri in Prof. Flückiger's laboratory (*Pharm. Journ.*, *April* 24, 1875,) gave the following results:—

	Patna garden opium, 1838.	Indian medical opium, 1852.	Abkari provision opium.	Garden Behar opium.	Malwa opium, flat cake.	Sind opium.	Hyderabad, Sind,	Khandesh.	Persian, 1872.
a—Ethereal extract, *i.e.* residue dried after the evaporation of the ether	24·2	21·7	22·0	20·6	14·1	17·4	20·4	...	25·0
b—Crude narcotine	10·0	9·0	8·5	7·6	7·6	8·0	9·7	...	10·2
c—Wax: difference between *a* & *b*	14·2	12·7	13·5	13·0	6·5	9·4	10·7	...	14·8
d—Purified narcotine	4·0	6·1	5·5	4·5	4·7	8·1	5·4	7·7	6·4
e—Crude morphine	11·2	11·2	14·1	10·6	14·4	...	...	...	...
f—Purified morphine	8·6	4·3	8·5	4·6	6·1	3·8	3·2	6·07	7·1

Professor Flückiger remarks:—

"The process for the estimation of narcotine and morphine was that described in the *Pharmacographia*, p. 59. The extract *a* of the above table is that afforded by means of boiling ether, with which the powdered opium had almost absolutely been exhausted by repeating the treatment with ether from about twenty to thirty times. The extract remaining after the evaporation of the ether was boiled with acetic acid, 1·04 sp. gr. This

liquid, after the acid had been driven off, yielded *b*, crude narcotine, as a crystalline brownish mass. It was washed with ether, and then afforded *d*, purified narcotine. Under *c* the difference between *a* and *b*, representing the amount of waxy matter, is calculated. It includes also the oily matter, with which the Persian opium is impregnated, as well as a little wax in the case of sample I.

In exhausting the opium with ether, a slightly yellowish fluid is obtained, which displays a bluish fluorescence, due to an unknown constituent of the drug.

Before precipitating the morphine, the aqueous solution was concentrated in order to get a smaller volume.

"It afforded *e*, the crude, dried morphine, which, after twice or three times repeated recrystallization, finally furnished *f*, purified morphine. This purification of morphine cannot be performed without a loss of morphine; the real practical percentage of that alkaloid may therefore more correctly be regarded as somewhat superior to the figure *f*. It would be desirable to apply a process furnishing the exact percentage; yet there is, as far as I know, no such method thoroughly satisfactory. I have been struck with the very large discrepancy, in the Indian opium, of the figures under *e* and *f*, which, I think, is larger than in opium from Asia Minor. Another fact well worth considering is the usually low percentage of morphine of Indian opium, narcotine being frequently present to a larger amount. This has already been pointed out in the *Pharmacographia*, page 57. It would appear, however, that this is of no consequence for the Chinese consumption, yet, possibly, it will be so some day if the home production of the Chinese further increases. Perhaps a more careful preparation of the Indian opium would at least prove of importance, not so much with regard to the smokers of the drug as to the possibility of extracting morphine from Indian opium profitably. It is not needful to point out that this would be highly desirable."

In the following table is shown the analysis of samples of Patna and Behar provision opium, Malwa opium and *pasewha*.* These analyses are interesting, as they indicate the amount of extractive obtained by the action of cold and hot water on the drug. The amount of extractive as well as the alkaloidal content varies within narrow limits from year to year. Analyses of Behar and Patna provision opium, arranged as shown in this table, are yearly placed before the merchants at the annual inspection of opium, which takes place before the first sale of the season:—

Variety of Opium	Moisture at 100° C.	Cold-water extract on anhydrous opium at 100° C.	Hot water extract on anhydrous opium at 100° C	Narcotine on anhydrous opium.	Morphia on anhydrous opium.	Total alkaloids.
Behar cake No. 1, manufactured 26th May 1883	26·43	64·25	65·54	5·91	3·86	...
Benares cake No. 4, manufactured 1st January 1883	29·97	63·8	64·57	5·91	4·58	...
Malwa opium, 31st March 1883	8·56	65·90	68·58	6·81	4·92	11·73
Pasewha from Benares District, 1886	19·75	66·31	70·46	5·04	3·19	8·23
Pasewha from Benares District, 1888	22·00	72·05	76·16	4·10	·85	4·95

Regarding the amount of morphia in Malwa opium, according to Dr. Smyttan, formerly Opium Inspector, Bombay, the best Malwa opium yields 8 per cent., Flückiger's analysis gives 14·4 per cent. of crude and 6·1 per cent of purified morphia, a larger yield than that obtained by Mr. Gregory, who only found 4·92 per cent. On the other hand, while Flückiger found only 4·7 per cent of narcotine, the Opium Factory analysis affords 6·81 per cent. Flückiger's analysis of Patna garden opium, in which 8·6 per cent. is given on the content of purified morphia, is an exceptional yield of the alkaloid for

* The analyses of Malwa opium and *pasewha* have been kindly furnished by Mr Gregory of the Benares Agency.

Bengal opium. The analyses of *pasewha* are of special interest as indicating the very wide differences which may occur in its composition.

INDIAN MANUFACTURED ALKALOIDS.—We have examined morphia, codeine and narcotine manufactured at Ghazipore.

The morphia hydrochlorate was in white acicular prisms of silky lustre and free from odour. Dried at 100° C., the crystals lost 12·74 per cent. The hydrochlorate is usually stated to contain three molecules of water, which would be equal to 14·38 per cent. The chlorine calculated as H Cl. amounted to 9·42 per cent., the sample was consequently deficient in combined acid to the extent of ·3 per cent. The ash amounted to ·063 per cent. By the action of chloroform ·812 per cent. of extractive was obtained. The precise nature of this extractive was not determined; it probably contained a trace of morphia; it was tested specially for narcotine with negative results. Uncombined morphia to the extent of ·828 per cent. was detected in the sample.

The codeine was a perfectly white powder, and free from odour. Dried at 100° C., it lost 5·16 per cent. The ash amounted to ·056 per cent. The saturating power of the alkaloid for standard acid corresponded closely with that acquired by theory.

The narcotine was in faintly yellowish crystals. It contained only a minute trace of ash, and was free from morphia.*

The following statistics of opium-eating at Balasore, in Orissa, have been collected by Vincent Richards. He says:—"I estimate that about one in every twelve or fourteen of the adult population use the drug; but I believe the habit is somewhat increasing; this increase in the consumption of the drug dates from the famine year 1866, and is not the result of a growing abuse of it by individual consumers, but of a more

* According to the late Surg.-Major Sheppard, in 1871 the cost of narcotine made at Ghazipore, including every charge, was 8 annas 11 pies per ounce, and the cost of morphia 3 annas per ounce.

extended use of opium amongst the general population. There can be no doubt that opium-eating was greatly resorted to in the famine year, because it mitigated the sufferings arising from hunger and sickness, and enabled the poor people to exist on less food. The number of opium-eaters examined by me was 613, of whom 444 were men and 169 women; of the 444 men, 29 were between 15 and 25 years of age, 87 between 25 and 35 years, 165 between 35 and 45 years, and 163 above 45 years. Thus, by far the greater number were over 35 years of age. Of those above 45 years, 56 were between 45 and 50 years, 74 between 50 and 60 years, and 33 above 60 years. Of the 169 women, 10 were between 15 and 25 years of age, 33 were from 25 to 35 years, 47 from 35 to 45 years, and 79 were above 45 years of age. Here, also, the proportion of those above 35 years is greater. Many were over 50 years of age and not a few 60. It must be understood that the ages are not given as exact; they are, however, approximately correct, and arrived at after careful inspection and inquiry. These remarks apply equally to the following, though the periods are not likely to be very inaccurate, as they embrace such a number of years. Not a few mention the famine year (1866) as the time at which they first contracted the habit. Of the men, 274 are said to have taken the drug for from 3 to 10 years, 100 for from 10 to 20 years, 48 from 20 to 30 years, and 22 for more than 30 years. Of the women 104 for from 3 to 10 years, 43 for from 10 to 20 years, 14 from 20 to 30 years, and 8 for more than 30 years. The average ages at which the habit was commenced were amongst the men from 20 to 26 years, and amongst the women from 24 to 30 years. The majority of eaters take their opium twice daily, morning and evening, but not a few in the evening only. Much depends upon the dose, and whether the person has been long addicted to the habit. The well-to-do people mix the drug with water and strain before drinking, but poor people swallow it just as it is sold by the opium vendor. The quantity taken varies from 2 grains to 45 or more daily; but as I shall show large doses are quite the exception, especially amongst

the poorer classes. Of the 444 men, 266 took from 2 to 4 grains daily, 151 from 4 to 12 grains, 18 from 12 to 16 grains, and only 9 more than 16 grains—average 7 grains. Of the 169 women 132 took from 2 to 4 grains, 33 from 4 to 12 grains, and 4 only from 12 to 16 grains; not one took more than 16 grains—average 5 grains. The dose when large has always been gradually increased from the beginning; but it is not at all unusual to find, when the dose is small, that there has been no increase at all. There is not, therefore, that craving for increasing doses, which is generally supposed to exist, nor do the 5 or 7 grains as sold by the vendors represent the actual amount of pure drug, as it is not unfrequently adulterated with catechu and other substances. I think it must be conceded that the foregoing data prove conclusively that excessive use of opium amongst the agricultural classes, and they are the chief consumers in Orissa, is very rare indeed, and that its moderate use may be, and is indulged in for years without producing any decided or appreciable ill effects, except perhaps one to which I shall allude hereafter, though it is a question whether the fact is not rather a blessing from a humanitarian point of view, when we consider how prone destructive agents, such as war, famine, and pestilence are to begin their work of destruction immediately the increase of population proceeds too rapidly." As to the causes which first lead to the use of the drug, they may be summed up as follows:—" Sickness, example, and a belief in its aphrodisiacal powers. The majority are induced to begin the habit through disease, such as fever, elephantiasis, dysentery, colic, rheumatism, and diarrhœa. Some few asserted that they took the drug to enable them the better to undergo fatigue, and to make long journeys. There is one almost inevitable result of a prolonged indulgence in opium-eating, especially if immoderate, namely, a weakening of the procreative powers; in no fewer than 99 cases out of 125 into which I particularly enquired with a view to ascertaining the fact, was this the case; moreover, of the 125 married men, averaging 36 years of age, the average number of children to each

was 1·11 after eleven years of married life. The average dose taken by these men was 14 grs. per diem, and the length of time they had been addicted to the habit 12 years. Opium-eating, at any rate in Balasore, does not conduce to either crime or insanity, since the inhabitants are a particularly law-abiding race, and the insanes are only 0·0069 per cent. of the population."—(*Indian Medical Gazette*, Vol. XII., No. 9, August 1st, 1877.) Our experience of opium-eating in India, though not supported by statistics, leads us to form the same opinion as Vincent Richards with regard to the moderate use of the drug. We believe that excessive indulgence in it is confined to a comparatively small number of people amongst the well-to-do and wealthy classes of the community. More recently (1881), Dr. Moore has published his experience of opium-eating in Rajputana, which supports strongly Richards' opinion.

Opium and all its alkaloids act almost exclusively on the central nervous system, and in mammals especially on the brain, the brain symptoms preponderating in proportion as the organ is developed relatively to the other nerve centres. When taken in small doses there is first a stage of excitement of the circulation, as evidenced by the pulse being fuller and quicker, and by the surface of the skin being warm and flushed. During this stage the individual has the power of directing his energies to any particular object, and the action of the drug causes him to do well whatever he wishes to do. Thus, if he wishes to sleep, and surrounding circumstances be favorable, an agreeable languor followed by quiet sleep comes on. He can be easily aroused from this sleep, and after a few hours the effect passes off, leaving, however, slight headache and languor, with dryness of mouth and slight nausea. If, on the other hand, he wishes to work, he can do this with increased energy; or, if he desires to exert the mind, he will find his imagination more vivid, his thoughts more brilliant, and his power of expression greater. (*Christison.*) With moderate doses the stage of excitement is short and is followed by deep sleep, from which the person can still be aroused. The after-effects

are severe headache, with nausea, furred tongue, and loss of appetite. During the stage of sleep the brain is anæmic, both the arteries and veins being empty. With large doses the first stage is very short. Sleep rapidly follows, becoming deeper and deeper, and passes into coma, from which the patient can no longer be aroused. The pupils become very much contracted, and the pulse from slow and full, becomes feeble. Finally death by asphyxia occurs, the respiration ceasing before the heart. It may occasionally be preceded by convulsions, though this is rare. Upon *post-mortem* examination the ordinary appearances of death by asphyxia are found. (*Lauder Brunton.*)

Although the symptoms which have been narrated are those usually produced by opium, yet in certain individuals the drug provokes quite different phenomena. One of the most common is an excessive depression following the sleep produced by moderate doses. The symptoms are a feeling of weakness and prostration, often accompanied by chilliness, dull headache, and giddiness, but especially marked by intense nausea and frequent vomiting. In some cases this condition of depression even replaces the normal second stage. A second and rarer idiosyncrasy towards opium exists in those persons who are rendered by it very delirious, it may be, even wildly so. In certain cases of opium poisoning, convulsions, either partial or complete, have occurred amidst the more usual phenomena. (*Wood.*) In childhood opium is badly borne owing to the preponderance of the brain over the rest of the body and the rapidity with which absorption takes place. Habit enables opium-eaters to take large quantities without danger to life, and in such persons the effects of the drug are very slowly produced, probably owing to a torpid condition of the intestines induced by the habit. Lauder Brunton suggests that the morphine of one dose may be converted in the organism into oxydimorphine, and thus exert an antagonistic action to the next dose. It has been stated that native opium-eaters eat large quantities of sweetmeats to counteract the effects of the drug.

Persons suffering from great pain will bear very large doses of opium; on the other hand, in any disease which interferes with excretion opium requires to be given with great caution.

Of the opium alkaloids morphia is almost purely narcotic. Codeine has a feebly narcotic action, but it greatly lessens the irritability of the nerves of the viscera, both thoracic and abdominal, whence its value in cough and diabetes. Narcotine is nearly related to codeine in its action, and has been largely used in India as an antiperiodic in doses of from 3 to 6 grains. Thebaine approaches strychnia in its action and is an active poison.

In connection with the effects of opium on the system, it is interesting to note that at the Government Opium Factories at Patna and Ghazipore, although men may be immersed above their knees for several hours daily in semi-liquid opium, as in the preparation of *lewa,* that no symptoms of the action of the drug on the system appear to ensue. Again, during the manufacture of opium into cakes for the China market, each cake-maker has as an assistant a boy of from 6 to 12 years of age. By the end of the day's work these children are literally smeared from head to foot with *lewa*, and although the special intolerance of children to opium is well established, cases of toxic symptoms ensuing appear to be unknown. In Patna, and probably also in the Ghazipore district, there is a belief that opium cake-makers are especially exempt from cholera. In certain instances the effects of constantly residing at a sudder opium factory appear to induce a torpid condition of the liver, leading to sub-acute congestion.

NOTE ON POPPY PETALS.—The use of poppy petals in the manufacture of the shell of the provision opium cakes has been already referred to; Mr Scott* states that the annual consumption of poppy petals is upwards of 16,000 maunds, for which supply the entire petals of no less than 4,710,400,000 flowers are required. During 1869-70, the sum of £10,235

* "*Manual of Opium Husbandry.*"

was spent by Government for the purchase of leaves (made from petals) for one Opium Agency. The ash yielded by Behar poppy petals has been examined by Warden*; after deduction of carbonic anhydride, sand and charcoal, its composition was as follows:—

Ferric oxide, 3·86; Aluminic oxide, 1·22; Magnesic oxide, 5·60; Calcic oxide, 10·72; Potassic oxide, 41·75; Potassic chloride, 12·28; Sodic chloride, 1·20; Sulphuric anhydride, 3·85; Phosphoric anhydride, 5·61; Silicic anhydride, 13·86.

The capsules and seeds of the poppy are prescribed by native doctors in diarrhœa; the former retain a small quantity of opium. From the seeds is made the Sharáb-i-kashkásh of the Mahometan physicians.†

The Malwa poppy capsules have been analysed by Lyon, of Bombay (1879), who obtained from them ·099 per cent. of alkaloids soluble in ether, consisting apparently of narcotine, ·023 per cent. of impure alkaloids soluble in benzol, and ·033 of impure alkaloids soluble in chloroform. No morphia could be detected in them by the ordinary reagents.

Toxicology.—Opium is chiefly used in India for suicide and infanticide. It is a common practice to swallow oil after the opium, and this is stated to be done by the most determined suicides, who knowing that an attempt will be made to recover them by treatment, have made up their minds to render it fruitless. The belief is that the oil unites with the opium and makes it adhere to the stomach in spite of emetics. Dr. Center remarks that it is possible that the oil might act as a mild laxative which would carry the poison more rapidly from the stomach into the intestines, out of the reach of emetics; while its absorption would go on as well in the latter as in the

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* *Chemical News*, xxxix., No. 999.

† Take half a maund of poppy seeds, soak them for twenty-four hours in four maunds of water, then bruise the seeds, replace them in the same water and boil down to one-half, rub on a strainer, and add one maund of sugar to the fluid obtained. Compare with Scrib. Comp. 73.

former. The quantity of oil taken is often enormous. Opium is also the favourite poison for infanticide. Generally a small quantity is smeared on the nipple and the child allowed to suck. For murder opium is rarely used. During the last ten years only one case has been observed in Bengal and one in the Punjab.

In Bengal the percentage of poisoning by opium in 1880-81, was 35·9 in 270 viscera examined; in 1881-82, 22·6 in 210; in 1882-83, 25·0 in 210; in the remaining nine months of 1883, 19·7 in 126; in 1884, 22·5 in 217; in 1885, 21·3 in 234; in 1886, 19·5 in 266; in 1887, 24·0 in 233.

In the Punjab the percentage was in 1879, 1·8 in 162 viscera examined; in 1880, 0·5 in 194; in 1881, *nil* in 186; in 1882, 1·9 in 201; in 1883, *nil* in 194; in 1884, *nil* in 200; in 1885, *nil* in 234; in 1886, 0·35 in 272; in 1887, *nil* in 228.

In the North-West Provinces and Oudh it is impossible from an examination of the Annual Reports to ascertain the number of human viscera examined during any one year, all the references being classed as "cases," but for the reasons already given, we may assume in the case of opium, that the detections were made in human viscera. The record shows in 1879, 18 detections in 156 cases; in 1880, 18 in 173; in 1881, 18 in 158; in 1882, 19 in 156; in 1883, 12·9 in 177; in 1884, 11·2 in 182; in 1885, 10·7 in 186; in 1886, 8·2 in 170; in 1887, 11·6 in 171.

In the Madras Chemical Examiner's reports we find under the head of "Human Cases, Class A, Viscera examined," that in 1882 opium was detected in 7 out of 152 cases; in 1883, in 9 out of 123 cases; in 1884, in 4 out of 85 cases; in 1885, in 6* out of 81 cases; in 1886, in 2 out of 84 cases; and in 1887, in 1 out of 76 cases. Under the head of "Suspected Attempts to Poison" no detections were made in the articles examined in 1882 and 1883; in 1884, one detection was made in 50 examinations; in 1885, two in 47 examinations; in 1886, four in 47 examinations; and in 1887 none.

* Of these two were morphia.

From the Bombay Chemical Examiner's reports it appears that during the five years ending the 31st of December 1887, the total number of deaths of human beings from poison reported to his office was 225, of which 66 or 29·3 per cent. were from opium. If, however, we take the ten years ending the 31st of December 1887, the figures are—Total deaths 467, of which 98 or 21 per cent. were from opium. The following table gives an analysis of the Bombay cases for the last ten years:—

	Fatal Cases.								Non-Fatal Cases.	Total Cases.
	Children.	Adults. M.	Adults. F.	Total deaths.	Suicide and unknown.	Accident.	Homicide.			
1878-79	...	1	5	6	6	...	...		1[1]	7
1879-80	1	5	4	10	8	2[2]	...		...	10
1880-81	...	5	1	6	6	...	..		1	7
1881-82	...	3	6	9	9	...	...		1[3]	10
1882-83	...	...	1	1	1	...	...		1[4]	2
1883	3	7	5	15	12	3[5]	...		2[6]	17
1884	1	3	5	9	8	1[7]	...		...	9
1885	...	9	9	18	18	...	...		2[8]	20
1886	2[9]	5	4	11	10	...	1		1	12
1887	...	7	6	13	13	...	...		1[10]	14
	7	45	46	98	91	6	1		10	108

[1] Detected in a paste on the end of an abortion stick.

[2] One of these in a child aged 2 years. The other a male adult from an overdose of Hydrochlorate of Morphia injected hypodermically.

[3] An attempt at suicide.

[4] In vomit of a man; supposed to have been administered to him in sweetmeat with what motive not stated.

[5] All three children, one clearly accidental, the other two doubtful.

[6] Both attempts at suicide by females.

[7] A boy aged 7 from drinking Kasumba.

[8] In one of these in sweetmeat; in the other opium forwarded for identification. History of case not given.

[9] One of these a case of suicide in a girl aged 13; the other apparently a case of homicide of an infant 2 months old.

[10] Liquor drugged with opium administered by a man to a woman; intent doubtful.

Commerce.—Purchase by Government. All opium is now received by Government on the *challán* or pass system, the *assamiwár*, which we have noticed above, having been abolished. On receipt at the factory it is submitted to examination.

The points that an Opium Examiner keeps before him, and that intuitively pass through his mind, in the physical examination of the drug are :—

(*a*) consistence,
(*b*) colour,
(*c*) texture,
(*d*) aroma.

Each one of the above points gives him some indication as to the quality of the drug and its ultimate appraisement, and also to its disposal for factory uses.

Consistence.—By this term we mean the actual percentage of solid and non-volatile matter in any given sample of the drug, if it were subjected to evaporation and reduced to dryness at a temperature of 200° Fahr.

Pure opium being paid for by Government at a fixed rate for a certain standard of consistence, and being subject to a *pro rata* increase or decrease in price according as it is above or below that standard, it will be readily seen that the importance of arriving at the true consistence of any given parcel of the drug stands second to none of the many duties devolving on the Opium Examiner.

By the help of sensitive balances and metallic tables heated by steam, accurate results in the estimation of consistence can be relied on, and the mechanical method pursued at the present day has already been noticed. Such a delicate operation, however, as the "assaying" of opium, (as the estimation of the true consistence by steam tables is termed), can be

applied to a very limited portion of the many thousand tons of the drug that pass through the factories. Every 100 grains of the drug, therefore, that is placed on the steam table is a representative sample of a large bulk that has been adjudged of nearly equal consistence by the remarkable power of hand estimation practised at the factories, a power that is gained only by years of experience in the examination of the drug.

It would be difficult therefore—nay impossible—to lay down rules for arriving at results that can be satisfactorily obtained only by practice. A few guiding principles will, however, be touched on here.

As a rule the consistence of opium freshly collected from the capsule varies considerably, according to peculiarities of soil and weather, ranging from 30° to 50°, that is, it contains from 30 to 50 per cent. of solid matter.

Between the time of collection, and of weighment and examination of the drug at the Government scales there is generally an interval of from one to even three months, and during this period it is within the power of the cultivator so to manipulate his drug as to raise it to any standard of spissitude. Experience, however, shows that the cultivator is not so easily schooled into turning out an article exactly suitable to the requirements of our factories, and it is no uncommon thing to find in one season two jars lying side by side, one of which contains opium yielding a clean section if cut with a spatula, the other containing a drug so fluid as to be poured out of the jar by tilting it over.

The practical impossibility of guessing with certainty to a degree the consistence of any given sample of opium has given rise to the "classes" of opium now obtaining at the two Agencies. Each class includes in it a range of three degrees of consistence, and between the first and the last class is included all the opium that is ordinarily brought to the Government scales.

The following is the classification table adopted for good opium at the two factories at Patna and Ghazipur, together with the distinctive mark of each class :—

Class.	Distinctive Mark.		Degrees included in each Class.
	At Patna.	At Ghazipur.	
Báshi bála darawal	$\overline{\overline{\mathrm{X}}}$	XXX	79, 80, 81
Bála darawal	$\overline{\mathrm{X}}$	XX	76, 77, 78
Darawal	X	X	73, 74, 75
Awal	I	I	70, 71, 72
Duyum	II	II	67, 68, 69
Siyum	III	III	64, 65, 66
Chaharum	...	IV	61, 62, 63
Panjum	...	V	58, 59, 60
Shishum	...	VI	55, 56, 57
Haftum	...	VII	52, 53, 54

For purposes of district classification the above table answers admirably, and it is also adhered to at the factories when re-classifying by touch the classification of district officers, prior to the ultimate appraisement of the opium by the help of steam tables. During this final classification, however, when the object at the factories is to arrive at the true consistence of every parcel of opium, drug of a spissitude estimated by touch to be above the highest or below the lowest class is assayed separately on the steam table, and its true consistence adjudged.

We have thus seen that there are two methods practised at the Agencies for estimating consistence, (*a*) by steam tables, (*b*) by touch. The second is a rough and ready method of assigning into one class masses of opium the true

average consistence of which is finally settled by the first method.

For the determination of consistence which is dependent only on the quantity of moisture contained in the drug the mode of procedure is a simple one and the results satisfactory. In practice, however, disturbing elements are very often introduced, and one of these is *pasewha*. Opium with an admixture of *pasewha* is deceptive to the touch.

In drug free from *pasewha* the granular texture appears to maintain cohesion between the particles which, as it were, support each other and offer a certain amount of resistance to pressure. In drug with a copious admixture of *pasewha* the granular texture is destroyed by the gradual merging of the tears into each other through the medium of the tenaceous and shiny *pasewha,* the cohesion existing is thus lessened, but the tenacity of the drug is increased.

Where the bulk of the produce at the factories lies somewhere intermediate, with regard to the admixture of *pasewha* between the two descriptions of drug given above, the sense of touch is regulated by what comes most in its way. When dealing, therefore, with varieties bordering on the two extremes of the drug we are apt to go astray, and we are thus able to account in a large number of cases for what is known as being "out in parakh" (judgment). We have thus prepared for ourselves an arbitrary and indefinable standard of "touch;" it is, nevertheless, a standard so generally accepted by all examiners of opium in the Agencies that it is practically a fixed one, and it is a recognised maxim that opium entirely free from *pasewha* will assay lower than this our accepted standard of touch, and that opium with a copious admixture of that substance will assay correspondingly higher. A good "parkhia" (examiner) will always, therefore, make due allowance for the absence or presence of *pasewha* in any sample of the drug that is being subjected to examination for consistence. The remarks made here refer entirely to good opium.

Another disturbing element in estimating consistence is heat, particularly on drug charged with *pasewha*. Drug of this character under the influence of heat, undergoes liquefaction to a moderate extent in the process of drying. Opium to be examined for consistence by touch, should invariably be placed, therefore, in shaded and cool verandahs, and the examination should be concluded by 9 or 10 o'clock in the morning, and before the sun gets hot. When, for want of accommodation, jars have to be placed in open yards, their examination should invariably be undertaken first, and in the early morning. The examination by touch, for consistence, of opium that is lying exposed to the sun's rays in the months of April, May, June and July, when all the examination at the factories is conducted, must always be faulty and conjectural, and should never be attempted.

Colour.—The natural colour of the drug runs through infinite shades of brown, from a dull or even bright chestnut to a reddish brown, and from a dark mahogany to a blackish brown. It even appears black at times when viewed in bulk.

These variations are due to causes with which we have no concern here, suffice it to say that they are natural, and to a practised eye easily discernible as the true colours of opium. Age and exposure may darken the colour of the drug but cannot alter its characteristics; and where an alteration appears it may be accepted as a sure indication of adulteration or sophistication of some sort, although, again, sophistication of the drug is possible without any perceptible alteration of colour.

The true colour of opium is clearly seen when the drug is viewed in a very thin film; this is best accomplished by pressing a small portion between two glass slips against the light, or by rubbing it down with the finger on a white earthenware plate. Here it is that we see clearly the various shades of chestnut, reddish brown, dark brown or mahogany, but never black. When rubbed between the fingers opium displays a shining surface and a waxy lustre.

The colour of opium is a valuable indication as to its purity.

Texture.—Like consistence and colour the drug delivered at the Government Factories may be said to differ, one sample from another, in texture. At the two extreme poles of variation there are the distinctly granular, and the perfectly homogeneous, and the bulk of the produce lies, as to texture, somewhere intermediate between those extremes.

The primary causes of variation, into which our enquiry does not extend, are undoubtedly due to differences in soil, and to conditions of weather obtaining at the time of collecting the drug; they are also due, to some extent, to manipulation of the drug after collection. A light-coloured, chestnut or reddish-brown variety of the drug, which is free from *pasewha,* will, as a rule, be found to be distinctly granular, while the dark, or blackish-brown variety, which has more or less of *pasewha* in its composition, or an excess of moisture, will on the other hand tend to the homogeneous type.

Ordinary manipulation, without the aid of sophistication, has little effect on texture, but long-continued manipulation will affect it materially. The presence of *pasewha*, again, affects it in a very marked degree, and so does an excess of moisture.

As already explained under the head "consistence," to the presence of *pasewha* in varying quantities is due the merging, more or less, of the tears into each other whereby the granular nature of the drug passes by imperceptible gradations to the homogeneous. The presence of *pasewha* also alters the dull waxy appearance of the drug to one that is more or less smooth and shiny, adding to it tenacity, and making it more glutinous. Ordinarily, opium, free from *pasewha,* is moderately ductile, but the presence of *pasewha,* by adding tenacity, increases also the ductility of the drug. This is seen by drawing out with both hands opium of high consistence. If free from *pasewha* it will be found to be ductile to an extent varying according to consistence, with a uniform and minutely granular texture. When there is *pasewha* present this ductility is increased, while the granular texture is less marked, according

to the proportion of *pasewha* present. The drug when thus drawn out breaks with an irregular fracture; it adheres to the fingers, is viscid and of a plastic nature. The texture of the drug is also well seen in high consistence opium when a section is exposed with a spatula.

Opium of the lower consistences—below about 66°—being in a somewhat fluid state, will not draw out at all but breaks off with ragged edges. Its texture is subject to change, under the same conditions, as in opium of higher consistences.

The texture of any given sample of pure drug is always uniform. A practised eye can at once detect any irregularity, and where such exists it betrays the presence of a foreign substance in the composition of the drug.

Aroma.—Chemistry has not yet isolated the volatile odorous principles of opium. Its aroma, however, is peculiar and characteristic. Some consider it not unpleasant, while others relegate it to the class of disagreeable odours. In well-prepared, fresh drug the aroma is decidedly fruity, but it varies with age, and is even said to vary somewhat with the description of soil on which the plant is grown, and with the manure used.

Careless preparation of the drug, such as its collection or manipulation in plates not scrupulously clean, or allowing it to come in contact with animal substances, such as bladders for storing it away in, or keeping it in ill-ventilated and smoky closets, or shutting it up for security in small, close receptacles, will dissipate and destroy the aroma in drug that is otherwise intrinsically good, and will even give it an offensive odour.

The aroma of the drug is one of its chief commercial criterions, and as such should be carefully guarded by the cultivator. To the Opium Examiner it gives a very important indication as to the suitability of the drug for the various Factory purposes. It is only by chemical tests that the Examiner can be certain that opium that is devoid of aroma or offensive to the smell, although apparently good as to texture and colour, has not also a foreign substance in its composition,

assuming that the foreign substance, if present, has not given the clue by its own specific odour. Under any circumstances, opium deteriorated in its aroma, although it may be otherwise pure, should be set aside, and utilised for other than the main Factory purpose, that is, amalgamation with drug intended for the central mass of cakes, otherwise there will be risk of the deteriorated drug tainting a much larger mass of good opium. (*Gregory.*)

Export.—India exported in 1886, 121,000 cwts. of opium, valued at 1,073 lacs of rupees; in 1887, 132,000 cwts., valued at 1,108 lacs; in 1888, 126,000 cwts., valued at 1,007 lacs.

PAPAVER RHŒAS, *Linn.*

Fig.—*Eng. Bot.* 645; *Bentl. and Trim., t.* 19. Corn Poppy (*Eng.*), Coquelicot (*Fr.*)

Hab.—A weed of cultivation. The capsules.

Vernacular.—Jangli-mudrika (*Bomb.*), Lálá (*Guz., Hind.*).

History, Uses, &c.—There is little to be found in Indian works about this poppy. It is the ῥοιάς of Theophrastus and probably the μήκων ῥοιάς of Dioscorides.* The Khash-khásh-i-Mansúr of the Arabs and Persians may possibly be the same plant; it is described by them as hairy, leaves much divided, capsules small; called Mansur, because it sheds its petals very quickly. In Guzerat and Northern India *P. Rhœas* is grown in gardens, and is called Lálá by the Mahometans, who suppose it to be the Lálá of the Persian poets. The name Mudrika given to the capsules means "stamped with the Mudra or Seal," which is used by Hindus after bathing, and which resembles the capsule in shape. This seal is impressed upon the forehead, both temples, both breasts, both shoulders and the pit of the stomach; that used by the followers of Vishnu is inscribed with the words, "*Shri Narayen,*" and is dipped in Gopichandan, a kind of white clay, and that used by the followers of Shiva bears the word "*Namás Shevaya,*"

* Theoph. Hist. Plant. ix. 13; Dios. iv. 62. Pliny also mentions the Rhœas or wild poppy, 20, 77; 21, 94.

and is dipped in Bhasam (ashes of cowdung). Some of the Swamis, or religious teachers, use a red-hot Mudra to stamp their disciples with. The milky juice of the capsules has a narcotic odour, and slightly sedative properties. Theophrastus says that the herb has the taste of wild endive, and Fée remarks that the peasants of Treves eat the leaves when young.

Description—The capsules are distinguished by their smooth globular form, those of *P. dubium* being twice as long as broad, and those of *P. hybridum* being bristly.

Chemical composition.—Hesse has obtained from the milky juice a colourless crystallizable substance, Rhœadine, $C^{21}H^{21}NO^{6}$, of weak alkaline reaction. It is tasteless, not poisonous, nearly insoluble in water, alcohol, ether, chloroform, benzol or aqueous ammonia, but soluble in weak acids; its solution in dilute sulphuric or hydrochloric acid acquires, after a time, a splendid red colour, destroyed by an alkali, but reappearing on addition of an acid. Owing to a statement made by Selmi that the capsules contain an alkaloid similar to morphia, Hesse has again examined them. He says:—"The juice collected in the morning under a clouded sky gave 35 per cent. of dried residue at 100°. The milky juice is at first mostly white; sometimes citron yellow; ferric chloride produces with it a deep red colour, which probably indicates the presence of meconic acid. 4·4 grammes of dry residue gave no trace of morphia, or of a similar alkaloid, 0·090 gramme gave equal to 2·1 per cent. of Rhœadine, and traces of another alkaloid. Rhœadine is not coloured by ferric chloride, but resembles morphia in being almost insoluble in ether." (*Liebig, annalen d. chemie, Vol. clxxxv., p.* 329.) Attfield, working on a large quantity of material, and by three different processes, failed to detect a trace of morphia in the petals. (*Pharm. Journ.* (3), *Vol.* 4, *p.* 290.)

ARGEMONE MEXICANA, *Linn.*

Fig.—*Bot. Mag., t.* 243; *Wight, Ill. ii., t.* 11. Gamboge Thistle, Mexican Poppy (*Eng.*), Pavot épineux, Chardon bénit (*Fr.*).

Hab.—America. Naturalized in India. The juice of fresh plant, and oil of the seeds.

Vernacular.—Bharbhand, Kutaila or Kutila (*Hind.*), Shiál-kantá (*Beng.*), Datturi (*Can.*), Birama-dandu (*Tam.*), Bramha-dandi-chettu (*Tel.*), Daruri (*Mar.*).

History, Uses, &c.—This is an American plant which has now run wild all over India; it may easily be known by its glaucous prickly thistle-like leaves, bright yellow flowers and yellow milky juice. The latter is used by the natives as an application to ulcers, and in combination with the juice of *Aristolochia bracteata* is given internally in syphilis and gonorrhœa. (*Hové, Tours* in 1787-88; *Bomb. Govt. Records No* 16, *New Series.*) In the Concan the juice with milk is given in leprosy. The seeds and seed oil have been used by European physicians in India, and there has been much difference of opinion regarding their properties, some considering them inert, and others asserting that the oil in doses of from 30 to 60 minims is a valuable remedy in dysentery and other affections of the intestinal canal. The evidence collected in India for the preparation of the Indian Pharmacopœia strongly supports the latter opinion; our experience is also in favour of it; and Charbonnier, who examined the oil in 1868, found it aperient in small doses; possibly those who have used the oil unsuccessfully purchased it in the bazaar, and were supplied with a mixed article; no bazaar-made oils can be relied upon. Further experiments with the oil fully confirm this opinion. Flückiger found 4 to 5 grammes to have a mild purgative effect. The smallness of the dose required to produce an aperient action, and the absence of any disagreeable taste, will probably lead to a more extended use of it as a substitute for castor-oil. An extract made from the whole plant has been found to have an aperient action, and the milky juice to promote the healing of indolent ulcers. We have not noticed any bad effects from its application to the eyes. Its use as an external application to the eyelids in conjunctivitis was probably introduced into this country with the plant by the Portuguese, who appear to

have adopted it in Brazil as a substitute for the Argemone of the Greeks and Romans (*Papaver Argemone*) which was used for that purpose.*

For a similar account of the properties of this plant, as observed in the West Indies by Hamilton, see *Pharmaceutical Journal* [i.], *Vol. IV., p.* 167.

Pouppé Desportes of St. Domingo describes the fresh seeds as emetic and slightly narcotic; he states that the oil obtained from them is used to relieve pain in dry colic.

Description.—The capsules are ¾ to 1½ inch long, terete, bristly, elliptic or oblong, and contain a number of dark brown rugose seeds, rather larger than black mustard. The oil has a bland nutty flavour; when first expressed it is sherry coloured, but becomes, after having been kept for some time, reddish brown.

Chemical composition.—The extract of the whole plant was examined by Haines (1863), who was unable to find any alkaloid in it. Charbonnier (1868) found a small quantity of morphia (?) in the leaves and capsules. The seeds contain in one hundred parts, 36 of oil, 49 of carbohydrates and albumen, 9 of moisture, and 6 of ash. The oil is of a light orange yellow colour and is almost tasteless, it has a specific gravity of about ·920, and remains clear at —8° C.; it dries slowly to a firm jelly, gaining during the process over 8 per cent. of its weight, and then ceases to give the red colour with nitric acid; it is only very slightly soluble in alcohol. The insoluble fatty acids amount to 90 per cent., and melt at 22° C. O. Frolich (1871) obtained from the oil a pretty hard soda soap, and found in the soap liquor, butyric, valerianic, acetic, and a little benzoic acid. According to Flückiger (1871) the oil has the specific gravity of ·919 at 16·5 C., remains clear at —·6 C., dries slowly and incompletely, and is not soluble in 6 volumes of 90 per cent. alcohol, as stated by Charbonnier. Dragendorff has found that the seeds contain an alkaloid

* Dios. ii., 168, 169. Apul. Platonicus de Vir. Herb. 32.

which can be isolated in precisely the same way as morphia, and which agrees with it in all important reactions. As the alkaloid occurs in a very small amount, a sufficient quantity has never been prepared for ultimate analysis. The ash of the seeds is largely composed of alkaline phosphates and sulphates.

Toxicology.—In 1878, a case occurred in Bombay in which a number of people suffered from vomiting and purging after using sweet oil which had been adulterated with Argemone oil. The adulteration may be detected by the rich orange red colour developed when strong nitric acid is added to the oil or to mixtures containing it. In the same year samples of oil were received by the Punjab Chemical Analyser from Amritsar, Simla and other towns which were said to possess irritant properties, causing purging and vomiting. The oil was stated to have been imported from the N.-W. Provinces and to have been made from Siyál-kánta (*Argemone mexicana*).

Commerce.—Occasionally large parcels of the seed are offered for sale, but they are not easily placed, as the oil burns with a very smoky flame.

MECONOPSIS WALLICHII, *Hook.*

Fig.—*Bot. Mag., t.* 4668.

Hab.—Temperate Himalaya.

Description.—*Meconopsis aculeata, Royle, Ill.* 67, t. 15; *Hook. Bot. Mag., t.* 5456, and *M. nepalensis, Dc.*, are reputed to be narcotic, but as O'Shaughnessy gave a drachm of the alcoholic extract of the former plant to a dog without producing any effect, it cannot have very active properties. *M. Wallichii* has been examined by us; it is a large herbaceous plant with tapering roots 6 inches long or more, sometimes bifurcated, 1½ inch or more in diameter, nearly smooth below, but at the upper part very scaly from the remains of leaves round the origin

of the flower stem, which is about 1 inch in diameter and hollow; between the scales are stiff yellow bristles. The root is brown externally, internally white, soft and spongy, with a large central pith. Odour somewhat musky.

Chemical composition.—The root dried by exposure to air, and reduced to a fine powder, lost 8 per cent. of moisture at 100° C. The ash amounted to 12·7 per cent., and contained a marked amount of manganese. The alkalinity calculated as K H O, after separation of lime, was equal to 8·6 per cent. Digested with light petroleum ether ·48 per cent. of a pale yellow, viscid, transparent, odourless extract was obtained. With the exception of a few white flocks the extract was soluble in absolute alcohol. On spontaneous evaporation shining laminæ separated, which under the microscope consisted of rhombic plates and needles: oil globules were also visible. The alcoholic solution of the extract was strongly acid. The amount of crystalline matter was too small to admit of the nature of the fat acid being determined. After exhaustion with light petroleum ether, the powder was dried by exposure to air, and then digested with ether. On evaporating off the ether, ·41 per cent. of a fragrant, soft, indistinctly crystalline residue was left. The extract was heated with dilute hydrochloric acid, and the soft, yellow, insoluble residue separated by filtration. The acid solution was rendered alkaline with ammonia, and then agitated with ether. On separation of the ether only a minute trace of residue was left, which did not respond to alkaloidal reagents. The yellow residue insoluble in H Cl. was treated with ammonia, and the turbid mixture agitated with ether. The ether left on evaporation a yellow, soft, non-crystalline residue, without taste or odour; which had the properties of a neutral resin. The aqueous alkaline solution after the separation of the ether, yielded yellow flocks when treated with dilute acids, which were re-dissolved by alkalies: this principle had the properties of a resin acid. The fragrant odour of the ethereal extract was probably due to a trace of benzoic acid.

After treatment with ether the powder was again dried, and then digested with absolute alcohol. The alcoholic solution was of a pale greenish colour, and possessed a marked greenish-yellow fluorescence; examined spectroscopically no absorption bands were visible. On evaporation, the alcoholic solution yielded 1·07 per cent. of extractive, yellow in colour, and possessing a somewhat fragrant odour. The extract was partly soluble in water. The aqueous solution did not possess any particular taste; it yielded slight precipitates with alkaloidal reagents; with ferric chloride no coloration was produced. On evaporation and ignition a trace of ash was left, possessing an alkaline reaction. The portion of the alcoholic extract insoluble in water, dissolved in alcohol, yielding a greenish solution, with acid reaction, and greenish-yellow fluorescence. The powder, after treatment with alcohol, yielded 12·6 per cent. of extractive to cold water. The aqueous solution was yellowish-brown in colour; alkaline in reaction; it afforded no coloration with ferric chloride; it slightly reduced an alkaline solution of copper on boiling.

FUMARIACEÆ.

FUMARIA OFFICINALIS, *Linn.*

Fig.—*Eng. Bot.*, 589. Common Fumitory (*Eng.*), Fumeterre officinale (*Fr.*).

Hab.—Persia, a weed of cultivation.

Vernacular.—Sháhterah (*Pers.*), Pitpápra, Sháhtera (*Hind.*, *Beng.*, *Bomb.*).

History, Uses, &c.—The Pitpápra imported from Persia does not appear to be *Fumaria parviflora*, as it has a smooth fruit without a double pit at the apex; it is doubtless *F. officinalis*. Several species of Fumitory have long been used medicinally, and were highly esteemed by the Greeks and Romans on account of their diuretic and alterative

properties. Dioscorides calls the plant Kápnos,* and Pliny derives the name Fumaria from Fumus, smoke, with the explanation that the plant irritates the eyes like smoke; it has also been called *Fumus terræ* with reference to the colour of the foliage, or its smell. Fumitory does not appear to have been mentioned by the early Sanskrit writers. The Arabians and Persians probably derived their knowledge of it from the Greeks, as they hold the same high estimate of its properties. In the Makhzan-el-Adwiya two varieties are mentioned, one with violet-coloured flowers, and a large kind with white flowers; it is described as diuretic and alterative, removing hepatic obstructions, aperient and expellant of the humors, but more especially of atrabilis; two Greek names are given, Kíasúsi and Káfnús; the Arabic names are Baklat-el-malik, and Shahteraj, a corruption from the Persian Shahtereh. In India the drug is still highly esteemed by the Mahometans. Jacquemont on his journey from Calcutta to Delhi observed Fumitory growing abundantly in wheat fields near Chittoor and in the Punjab. He describes it as very near to, if not *F. officinalis*. It was probably *F. parviflora*, which is used in Northern India as Fumitory.

For a European account of the properties and uses of Fumitory, Handschuch "*De plantis Fumariaceis,*" may be consulted. Fumitory is laxative and diuretic; it is beneficial in dyspepsia depending upon torpidity of the intestines and in scrofulous skin affections. Dose—2 ounces of the decoction (1 ounce to 1 pint) three times a day.

Description.—The dry plant is generally much broken up; mixed with it are many nearly globular, smooth, indehiscent capsules, the size of a large pin's head and umbilicate at the top; seed single, dark brown, crested, with a depression on one side; odour hardly any; taste bitter, slightly acrid and astringent.

* Dios. 4, 105. Plin. 25, 98, 99. Sibthorp refers the καπνος of Dioscorides to *F. parviflora, Lam.*, a plant with white flowers; probably both were used.

Chemical composition.—Fumitory contains—1*st*, Fumaric acid, $C^4 H^4 O^4$, an acid isomeric with maleic acid, differing from malic acid by containing 1 at. less of water, and from succinic acid by containing 2 at. less of hydrogen; it exists ready formed in several other plants, *viz.*, *Corydalis bulbosa*, *Glaucium flavum*, *Lichen islandicus*, and *Boletus pseudo-ignarius*; it is produced by the dehydration of malic acid, by molecular transformation of maleic acid, namely, when that acid is heated with hydriodic or hydrobromic acid (*Kekulé, Ann. ch. Phar., Suppl.* ii., 85), and according to Multhausen (*Ann ch. Phar. ci.*, 171), is found among the products of the oxidation of protein compounds by nitro-muriatic acid. (*Watts' Dict. of Chemistry.*)

2*nd*, Fumarine, an organic base first observed by Peschier (*Liebig, Organische chemie, p.* 633), and more fully examined by Hannon (*J. Chem. Med.* [3], VIII., 705). The plant gathered while in full flower, contains from 5 to 6 per cent. of this base, to which it appears to owe its specific physiological action. Fumarine is separated from its salts by caustic alkalies or their carbonates in the form of a curdy precipitate; it may be obtained in the crystalline form by spontaneous evaporation of its hot alcoholic solution, but not by evaporation with the aid of heat; the salts have a bitter taste. (*Watts' Dict. of Chemistry.*) According to Preuss, fumarine crystallizes in irregular 6-sided, monoclinic prisms, soluble in alcohol, chloroform, benzol, carbon bisulphide, and amyl-alcohol, sparingly soluble in water, insoluble in ether; its composition has not been determined.

Commerce.—The drug is imported from Persia under the name of Shahterah. Value, about Rs. 4 per Surat maund of 37½ lbs.

The medicinal plants of minor importance belonging to the Fumariaceæ are :—

Hypecoum procumbens, *Linn.*, *Schk. Han.* 1, *t.* 27, found in Sind, Afghanistan, and the Punjab salt range. It

appears to be the ὑπηκόον of Dioscorides, and Hypecoum of Pliny, now known as Cumin cornu or Horned cummin, and like fumitory, a weed of cultivation.

Corydalis Govaniana, *Wall., Royle Ill.*, t. 16, f. 2, a plant of the Western Himalaya, has a yellow juice which is employed medicinally in the treatment of eye diseases like Mámirán. (*Aitchison, Journ. Linn. Soc.* 19, p. 145.) The chemical composition of these plants closely resembles that of Fumaria. They have been used as alteratives, but are of little importance.

CRUCIFERÆ.

ANASTATICA HIEROCHUNTINA, *Linn.*

Fig.—*Jac. Vind.* 1, *t.* 58. Rose of Jericho (*Eng.*), Rose de Jericho (*Fr.*).

Hab.—Syria.

Vernacular.—Kaf Maryam, Kaf Ayesha (*Arab.*), Garbha phúl (*Hind., Guz.*).

History, Uses, &c.—This is a small annual plant growing in sandy wastes in Syria, and is supposed to be the Gurgal, rolling thing, or wheel of Isaiah. There is a tradition that the plant expanded at the birth of the Saviour. Mahometan writers have appropriated this tradition in favour of Ayesha, the favourite wife of the Prophet and mother of the Faithful; the opening of the plant when wetted being considered symbolical of the opening of the womb in child-birth. The branches of Anastatica when in flower, spread out rigidly upon the ground, but when the seed ripens they curl up and form a round ball; this, when placed in water, expands, and the pods after a time open and discharge their seeds; the property of expansion when moist, and closure when dry, is retained for years. There can be little doubt that the dried plant was first introduced into India by the

Mahometans; it is kept in all druggists' shops, and is prescribed in difficult labour, being placed in water until it expands, when the water is administered to the patient. This plant has been supposed by some to be the seed-bearing Amomum of Dioscorides. (*See Primulaceæ.*)

Description.—Stem short and woody, branched in a corymbose manner at the top; leaves obovate, the lower ones entire, the upper remotely toothed; flowers small, yellowish white, forming spikes along the branches; the fruit is a short pouch with a strong curved beak, and two ear-like projections on each side; it is divided into four cells, each cell containing a yellow concavo-convex seed. The whole plant is tomentose, and has hardly any taste; as seen in the shops, it presents the appearance of a little ball of wicker work about the size of a large egg at the top of the unbranched part of the stem.

Commerce.—It is imported from Syria by way of the Persian Gulf.

LEPIDIUM IBERIS, *Linn.*

Fig.—*Lob. Ic., t.* 223. Peppergrass or Pepperwort (*Eng.*), Passerage ibéride (*Fr.*).

Hab.—Southern Europe to Siberia. The seeds.

Vernacular.—Towdri (*Pers.*).

History, Uses, &c.—These seeds are imported from Persia. In some English books upon Indian Materia Medica they are attributed to *Malva sylvestris*; in others to *Cheiranthus Cheiri*; neither of these suppositions can be correct, as the parcels of seed, when they arrive in Bombay, contain corymbs of small pods, much like those of common Candytuft. Ibn Sina, incorrectly quoting Dioscorides, describes توذری Tozeri as a plant like Farasiyun (πράσιον) with black seeds. (*See Farâsiyun.*) Mír Muhammad Husain gives the following account of Towdrí:—"A Persian name, in Greek Arusiman,* in Arabic Bazr-el-khum-khum, Bazr-el-hawah, and Kasísa; at

* ἐρύσιμον of Dios. is generally considered to be *Sisymbrium officinale.*

Ispahan it is called Kadúma; in Kirmán Márdarakht; at Tabriz, Darína. The plant has long leaves, without stalks; the branches are red, stiff and armed with a few prickles; the seed is in a small pod, and of the shape of a lentil, but much smaller; there are three varieties—red, yellow, and white; the latter is the largest. Towdrí is hot in the second degree, and moist in the first: some say dry. Properties aphrodisiac, fattening the body, and purifying the blood." The drug is in general use for the abovementioned properties, which are attributed by the natives to most of the cruciferous seeds. Some of the Towdrí seed is doubtless the produce of *Lepidium Iberis, Linn.*, a plant whose habitat extends from Southern Europe to Siberia. This plant was known to the ancients and employed as a rubefacient in rheumatism, &c.; the seeds taken internally were prescribed in bronchitis and dropsy.* According to Pliny they were first used by Damocrates. Corre and Lejanne state that *L. Iberis* is called Cresson de Savane in the Antilles, and is considered to have all the properties of water-cress.

A tea made from *L. ruderale* is used in Russia in intermittent fevers. A rare pepperwort found in some seaside places in Britain.

Description.—All three kinds are similar in shape to the seeds of Candytuft; the so-called white variety is only somewhat paler than the red; a brown-coloured sort is sometimes met with under the name of "Black Towdrí." When soaked in water the seeds become thickly coated with mucilage.

Chemical composition.—Leroux (1837) obtained from the flowering tops and seeds of *Lepidium Iberis* an amorphous bitter principle which he named Lepidin. The plant also yields a sulphuretted volatile oil.

Commerce.—It is imported from Persia. Value, Red, 3½ annas per lb.; White, 5 annas per lb.

* λεπιδίον Dios. ii. 165. *ἰβηρὶς* said by Paulus Ægineta in his Third Book to be same as λεπιδιον. See also Plin. 25, 49, App. Herb. 20. Sibthorp refers λεπιδιον to *L. latifolium, L.*, and *ἰβηρὶς* to *L. graminifolium, L.* We may conclude that several species were used.

Dr. Stewart states that in the Punjab and Sind *Matthiola incana, R. Br.,** is grown for its seeds, which constitute one of the several kinds of "Todrí." In short this Persian name appears to have much the same meaning as the λευκόïον of the Greeks, being applied loosely to several Spring flowers. (*See* remarks on *Cheiranthus Cheiri.*)

LEPIDIUM SATIVUM, *Linn.*

Fig.—*Wight, Ill. ii.*, 12; *Smith, Fl. Gr., t.* 616. Common Cress (*Eng.*), Cresson (*Fr.*).

Hab—Cultivated in all countries. The seeds.

Vernacular.—Hurf, Halim, Chansar (*Hind.*), Assalia, (*Guz.*), Ahaliva (*Mar.*), Ali-virai (*Tam.*), Ádeli (*Tel.*)

History, Uses, &c.—The common cress is generally supposed to be a native of Persia, from which country it was probably introduced at an early date into India. The seeds are called Chandrasura in Sanskrit works, and are described as tonic and alterative; water, thickened with the mucilage which they give out, is recommended in the Bhavaprakása as a remedy for hiccup. The confection or Rábarí containing *ghi* and sugar is used as a restorative tonic, and the seeds are added to purgatives. The Mahometan writers identify cress with the καρδαμον of the Greeks,† and give Hab-el-rashád as the Arabic name for the seeds, which they consider to be hot and dry in the third degree, and to have aphrodisiac and diuretic properties; they recommend them for the dispersion of certain chronic enlargements of the spleen, &c., and as an alterative in various diseased conditions supposed to be produced by cold humours.

Chemical composition.—The herb and seeds of *L. sativum* bruised and macerated and distilled with steam, yield a volatile aromatic oil which does not separate spontaneously from the

* Purple Gillyflower. Eng. Bot., 1935. Quarantaine (*Fr.*)

† Dios. ii. 114; Nasturtium of Pliny, 19, 44; 20, 50; Theoph. H. P. I. 19; vii. 1, 4, 6.

watery distillate, but may be extracted therefrom by agitation with benzene. Three-fourths of the crude product boiled at 226·5°, exhibited the composition of pure a-toluonitril, phenyl-aceto-nitril, or phenyl-methyl cyanide, $C^6 H^5 CH^2 CN$, and when heated to 200° for a short time with hydrochloric acid, yielded phenyl-acetic acid. The same composition is exhibited by the volatile oil of *Tropæolum majus*. *Nasturtium officinale* yields by similar treatment an oil which may be separated from the watery distillate by agitation with light petroleum ether, this solvent being afterwards evaporated off in a paraffin bath at 140°. By fractional distillation of the remaining liquid, an oil was obtained, boiling at 253·5° (261° corr.), and having a specific gravity of 1·0014 at 18°. This oil was found by analysis to have the composition of phenyl-propionitril, $C^6H^5 CH^2 CH^2 CN$; and on fusing it with potash, decomposing the resulting potassium salt with hydrochloric acid, and extracting with ether, phenyl-propionic acid was obtained in long needles melting at 47°. (*Hofmann.*)

The fatty oil of Cress seeds is described by Schübler as of a brownish yellow colour, sp. gr. 0·924; it thickens and becomes turbid at 6° to 10°, and congeals at 15° to a yellow mass. It has a peculiar smell and taste, and dries slowly.

Commerce.—Cress seeds are imported into Bombay from Persia under the name of Assália. Value, Rs. 3¼ per maund of 37½ lbs.

SISYMBRIUM IRIO, *Linn.*

Fig.—*Eng. Bot.* 1631; *Reich., Ic. Fl. Germ., t.* 75, *f.* 4408. Hedge Mustard, London Rocket (*Eng.*), Herbe aux Chantres, Tortelle (*Fr.*).

Hab.—Northern India, Persia, Europe. The seeds.

Vernacular.—Khúbkalán (*Hind.*), Khákshí (*Pers., Bomb.*), Rán-tikhí (*Mar.*).

History, Uses, &c.—There is no notice of this drug in the Hindu Materia Medica; it appears to have been intro-

duced into the country by the Mahometans as a substitute for *S. officinale,* the ἐρύσιμον of Dioscorides,* and the Irio of Pliny,† which is reputed to be good for asthma, hoarseness, or any debility of the throat or vocal organs; as also to promote expectoration. In India the seeds are much used in restorative and fattening confections. *S. Irio* was once common about London, and was called London Rocket; it covered the ground in the spring after the great fire of London, and Hallen records that *S. officinale* springs up wherever houses have been burnt. It is a common weed in Persia, and is known by various names in different parts of the country, *e.g.*, in Fars, *Shafterak*; Khorasan, *Khákshí*; Tabriz, *Surdan*; Turkistan, *Shiwaran*; Mazenderan, *Shalumbi.* In Arabic it is called Khubah. Medicinally it is thought to be expectorant, stimulant and restorative; it is also used externally as a stimulating poultice; a large quantity is imported, as it is in constant demand among the Mahometans of India. The plant also grows in Northern India.

Description.—Khákshí is a small red oblong seed about 1-20th of an inch long, one surface is convex, the other grooved, the groove ending in a notch; when placed in water it becomes coated with a transparent mucilage; the cotyledons are yellow and oily. The seed turns rancid if kept for any time; it has a hot flavour like mustard.

Commerce.—It is imported from Persia. Value, Rs. 5 per Surat maund of 37½ lbs.

BRASSICA NIGRA, *Koch.*

Fig.—*Bentley and Trim.*, *t.* 22. Black mustard (*Eng.*), Moutarde noire (*Fr.*). The seeds.

BRASSICA CAMPESTRIS, *Linn.*

Fig.—*Eng. Bot.* 2146. Rape (*Eng.*), Navette, Ravette (*Fr.*). The seeds and oil.

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* Dios. 2, 147; Theophr. H. P. viii. 7.

† Plin. 18, 22; 22, 75. Sibthorp refers ἐρύσιμον to *S. polyceratium, L.*; probably more than one species was used under this name.

BRASSICA JUNCEA, *H. f. and T.*

Fig.—*Jacq. Vind., t.* 171. Indian mustard (*Eng.*), Moutarde rouge (*Fr.*). The seeds.

Hab.—Cultivated universally.

Vernacular—*B. campestris,* Surson (*Hind.*), Sherus (*Mar.*), Sarasava (*Guz.*), Sasave (*Can.*). Other varieties, Rai (*Hind., Guz.*), Kadugu (*Tam.*), Ávêlu (*Tel.*), Mohari (*Mar.*).

History, Uses, &c.—One of the Sanskrit names for mustard is Ásuri or "the sorceress," because witches are detected by means of mustard oil. By lamplight several cups are filled with water and the oil dropped in, each cup bears the name of one of the suspected women in the village, and if during the ceremony they observe that the oil takes the form of a woman in any of the cups, they conclude that the person whose name is on that cup is a witch. Mustard is also symbolic of fecundity; in the story of Gul-i-Bakawli, the nymph Bakawli is born again of a peasant woman who had eaten mustard oil extracted from seed grown upon the site of her disappearance. Mustard is mentioned by Greek writers as νάπυ and σίνηπι, and appears to have been used by them as a medicine.* There is reason to suppose that the Romans used it as a condiment and medicine. *Cf.* Pliny 19, 54 and 20, 87, who mentions three varieties. Fée identifies the slender-stemmed mustard of that writer with the *Sinapis alba* of Linnæus, the mustard mentioned as having the leaves of rape he considers to be the *Sinapis nigra,* and that with the leaf of the rocket, the *Sinapis erucoides* of Linnæus. Sanskrit writers call mustard seeds Sarshapa and notice two kinds, sidhartha or white mustard (*B. campestris*), and rajika or brown mustard (probably *B. juncea*). The first kind is almost exclusively used for the production of the expressed oil,* while the brown or black mustards are preferred on account of their greater pungency as rubefacients and for internal administration. The expressed oil of mustard

* Dios. 2, 143.

† Colza and Carcel oil of commerce.

is largely used as an article of diet, and when applied to the skin is considered to keep it soft, cool, and clean, and to promote the growth of hair. In Bengal it is much used by males for rubbing over the body before bathing, females always using cocoanut oil, either plain or perfumed, for the same purpose. Internally the Hindus use mustard combined with other stimulants in dyspepsia and as an emetic; externally they use it in much the same way as we do in Europe, but with the addition of other drugs, most of them of doubtful efficacy. In the Concan the whole seeds, moistened in warm water and sprinkled with lime, are given as a remedy for dyspepsia. In the Makhzan-el-Adwiya three kinds of mustard are noticed. Wild mustard, with small round reddish brown seeds, and two sorts of cultivated mustard, the white and the red. The seeds of the latter are directed to be used for medicinal purposes; they are described as large and not round. The Mahometans consider mustard to be hot and dry, and to have detergent and digestive properties; they prescribe it internally in many diseases in which they think such remedies are indicated; externally they apply it in a variety of ways as a stimulant and counter-irritant. The list of diseases in which it is recommended, and the method of application or administration in each is too long to reproduce here. (*Cf.* Makhzan, article Khardal.) Modern research has shown that essential oil of mustard has antiseptic properties and is destructive of bacteria; it is intensely irritant, and if taken internally would act as a powerful irritant poison. The seeds share its properties, and when powdered and mixed with water act upon the skin and mucous membranes as a stimulant of the circulation, causing heat, redness and pain if the application is short, but vesication and much irritation if too prolonged. It is therefore a most valuable counter-irritant in neuralgic pains and internal congestions. Applied as a hip bath it acts as an indirect emmenagogue by stimulating the circulation. Given internally to the extent of a heaped dessert spoonful in a pint of warm water or gruel, mustard flour acts rapidly as an emetic through its irritant action on the mucous membrane of

the stomach, and is therefore useful when narcotics have been taken in poisonous doses. In small doses mustard flour is carminative and sialagogue, and promotes digestion by increasing the flow of saliva and gastric juice. The seeds act in the same way, but owing to their mucilaginous coating the action is more prolonged and milder. During excretion mustard irritates the kidneys and causes diuresis.

Description.—Four kinds of mustard are generally to be found in the Indian market, namely, 1*st*, Karachi mustard, *B. nigra*, var (?)—Globular, of a dark brown colour, surface rough, generally covered with a white pellicle, giving the seeds a grey colour; size about $\frac{1}{16}$ of an inch in diameter.

2nd, B. nigra—Seeds globular, dark reddish brown, clean and bright; size about $\frac{1}{25}$ of an inch in diameter; surface rough, but less so than that of the 1st kind.

3rd, B. juncea—Seeds oblong, light reddish brown, clean and bright; length $\frac{1}{12}$ of an inch; surface does not appear rough unless magnified.

4th, B. campestris—Seeds very slightly oblong, yellow, or reddish brown, clean and bright; diameter $\frac{1}{12}$ of an inch or more; surface smooth to the naked eye, but seen to be finely reticulated under a magnifying glass.

The third kind is preferred by the natives, and may be considered the officinal mustard of India; it has a very bright rich yellow colour when powdered.

Microscopic structure.—The white pellicle which covers the Karachi seeds consists of hexagonal cells. The epidermis of the different kinds of seed consists of one row of closely packed cells, having strong lateral and inner walls; the cells are best seen in the Karachi mustard on account of their greater size.

Chemical composition.—By distilling the seeds (previously macerated) of *B. nigra* and *B. juncea* with water, the pungent

principle, essential oil of mustard is obtained, amounting to ·2 or ·7 per cent., and under certain conditions more from *B. nigra.* This oil, which has the composition $C S N C^3 H^5$, allyl thiocarbimide, boils at 150°·7 C., has a specific gravity at 0° of 1·036, no rotatory power, and is soluble without coloration or turbidity in three times its weight of cold strong sulphuric acid. The remarkable reaction which gives rise to the formation of mustard oil was explained by Will and Körner in 1863. They obtained from mustard a crystallizable substance, then termed *Myronate of Potassium*, $C^{10} H^{18} K N S^2 O^{10}$, but now known as *Sinnigrin*, from its analogy to *sinalbin.* Sinnigrin when brought into contact with an extract of white mustard or a solution of myrosin, is decomposed into essential oil of mustard, potassium sulphate, and glucose. At the same time a part of the oil is converted into sulphur and crotonitril. (*Roscoe.*) Myrosin is an albumenoid principle contained in white mustard. Its aqueous solution coagulates at 60° C., and then becomes inactive : hence mustard seed which has been roasted yields no volatile oil, nor does it yield any if powdered and introduced at once into boiling water. Sometimes black mustard contains so little myrosin that white mustard has to be added to it in order to develope all the volatile oil it is capable of yielding. Sinalbin is another compound contained in white mustard seed; it is easily soluble in water, less so in alcohol, and crystallizes in small pearly needles. By the action of myrosin it is converted into sinalbin-mustard-oil, and sulphate of sinapine and glucose. For further information the reader is referred to Roscoe and Schorlemmer's work on Organic Chemistry.

The seeds, roots and herbaceous parts of many of the Cruciferæ yield a volatile oil composed in part of mustard oil and in part of allyl sulphide, $C^6 H^{10}S$, which is also obtainable from garlic. Many Cruciferæ afford from their roots or seeds chiefly or solely oil of mustard, and from their leaves oil of garlic.

The following percentage analyses of mustard seeds are given by König (*Zusamm. d. mensch. Nahrungs, &c., p.* 148) :—

	Description.	Date.	Water.	Nitrog. Matters.	Fixed Oil.	Myron. Acid.	Bitter Salt.	Cellulose.	Ash.	In dry substance. Nitr.	In dry substance. Oil.	By whom examined.
1	....	1863	7·50	18·36 Myrosin + Albumin	26·20	...	...	...	4·00	...	28·25	R. Hoffman.
2*	Black mustard seed.	1876	4·84	29 53	35·70	4·84	3·59	(16·76)	4 72	5·32	37·52	H. Hassall.
3*	White do ...	„	5 36	27·48	35·76	...	10·98	(16·29)	4·11	5·55	37·79	H. Hassall.
4*	Do. York-shire.	1881	9·32	28·37†	25·56	...	...	10·52	4·57	5·00	28·19	Piesse and Stansell.
5*	Do. Cam-bridge.	„	8·00	28·00†	27·51	...	...	8·87	4·70	4·88	29·90	Piesse and Stansell.
6*	Black do. Cambridge.	„	8·52	26·50†	25·54	1 69	...	9·01	4·98	4·79	27·92	Piesse and Stansell.
	Average......		7·26	27·99	29·38	3·24	(17·66)‡	12·29	4·18	5·11	31·48	

* Containing—		Volatile Oil.	Nitrogen.	Sulphur.
Mustard Seed No. 2	...	1·271	5·068	1·413
„ „ 3	...	......	5·285	1·224
„ „ 4	...	0·06	4 54	0·99
„ „ 5	...	0·08	3·49	0·93
„ „ 6	...	0·47	4 38	1·28

† Containing Myrosin + Albumin No. 4, 5 24. No. 5, 4·58. No. 6, 5 24 per cent.
‡ Calculated by difference

Mustard seeds submitted to pressure afford about 23 per cent. of a mild-tasting,* inodorous, non-drying oil, solidifying when cooled to —17·5° C., and consisting of the glycerin compound of stearic, oleic and erucic or brassic acid. The last named acid occurs also in rape, and grape seed oils, and is homologous with oleic acid.

The ash constituents of mustard, amounting to 4 per cent., consist chiefly of the phosphates of calcium, magnesium and potassium.

The mustard oil sold in the bazars of India has a pungent odour and bitter taste, owing to the practise of watering the cake before pressing it the second time. It is also said to be largely adulterated in Bengal with poppy seed and other oils. Through the kindness of Mr. Blechenden, Secretary, Agri-Horticultural Society of India, we have had an opportunity of

* When freshly-expressed it has the taste of mustard without th pungency.

examining a specimen of pure mustard oil expressed in a Merce's patent iron mill at the Calcutta Exhibition of 1884. The oil was of a pale yellow colour, with a somewhat nutty and very faintly pungent taste, and faint odour of mustard. At 15°·5 C. it had a specific gravity of ·9286. At —9° C. it became as viscid as thick treacle.

The seeds of *B. campestris* yields a brownish-yellow, nearly inodorous and tasteless oil, having when expressed hot, or when long kept, a disagreeable after taste. Sp. gr. about 0·9136. (*Schübler.*) It is the least limpid of the Brassica oils, at —4° it deposits a little fat, and solidifies to a yellow butter at —6°. The cold-pressed oil contains, on the average, 70·32 per cent. carbon, 10·58 hydrogen and 19·10 oxygen; it forms with chlorine a yellow, very viscid compound containing 17·68 per cent. of chlorine, and with bromine a similar compound containing 32·5 per cent. of bromine. *B. campestris* contains myrosin but no sinnigrin.

According to W. J. Smith (*Zeit. Phys. Chem. xii.*, 419), the greater part of the sulphur occurs combined in the glucosidal compound sinnigrin, a smaller quantity occurs not so combined; and in addition there is that which is present as a constituent of albumen. With the germination of cruciferous seeds the glucoside is gradually broken up, but after an interval of several weeks some of it reappears in the leaves of the plant. The rate at which the glucoside in these seeds is broken up in the presence of water was found to vary considerably in different species, and it was further found that the ferment from any cruciferous seed is capable of breaking up the glucoside of any other cruciferous seed. It is therefore inferred that all these seeds contain one and the same ferment, whilst, on the other hand, the glucosides of different species vary considerably in respect to their susceptibility to the ferment.

According to Messrs. Schimmel, the quantity of sulphuretted oil yielded by *Brassica nigra* seeds is 0·90 per cent., and by the seeds of *B. juncea* 0·52 per cent.

Commerce.—Mustard is grown in most parts of India, the price ranges from Rs. 20 to Rs. 40 per candy according to quality and cleanness of seed. Rape is worth about Rs. 7 per cwt.

RAPHANUS SATIVUS, *Linn.*

Fig.—*Lam. Ill., t.* 566. Radish (*Eng.*), Radis (*Fr.*).

Vernacular—Mula, Muro (*Bomb., Hind.*), Mullangi (*Tam., Can.*), Mulaka (*Sans.*).

Description.—A large, coarse white radish, is universally cultivated in India. The seeds Bazr-el-fujl (*Arab.*) are used as a diuretic, laxative and lithontriptic; also the juice of the fresh leaves. The root and seeds yield with water a milky distillate, from which a small quantity of oil may be obtained by rectification; it is colourless, heavier than water, and has the taste but not the smell of radishes. The oil contains sulphur; it forms a white precipitate with corrosive sublimate, and yellow with bichloride of platinum. It dissolves with tolerable facility in water.—(*Pless, in Gmelin's Handbook, X.,* 56).

The following percentage analyses of Radishes are given by König (*Zusamm. d. mensch. Nahrungs, &c., p.* 137):—

When collected	Water.	Nitr. subs.	Fatty matter.	Sugar.	Non-nitr extractive.	Cellulose.	Ash.	In dry substance.		By whom examined.
								Nitr.	Carbo. Hydr.	
* May 1874 ...	91·31	1·15	0·09	1·14	1·97	0·65	0·67	3·23	54·66	W. Dahlen.
† Oct. „ ...	93·47	1·45	0·11	0·52	2·80	0·73	0·93	3·55	59·84	
1876 ..	92·28	1·09	0·26	4 92		0·87	0·63	2 24	63·32	R. Pott.
Average	93·34	1·28	0·15	0·88	2·91	0·75	0·74	3·01	56·27	

* It contained Phosphoric acid 0·057, and Sulphur organically combined 0·011 per cent.

† It contained Phosphoric acid 0·090, and Sulphur organically combined 0·023 per cent.

The other Cruciferous plants known in India, which are more or less medicinal, are the following:—

Cheiranthus Cheiri, *Linn.*—The Wallflower is cultivated in Northern India under the name of Todri. This plant and *Matthiola incana* are considered by many to have been the λευκόϊον of the Greeks and Viola of the Latins, names which appear to have been rather loosely applied to several Spring flowers. The Germans still call the Wallflower 'Leucoje' and the French know it as Violier as well as Giroflée. Leukoion is described as emmenagogue and deobstruent by Dioscorides, and the Mahometans of India attribute such virtues to the flowers. The seeds contain myrosin and the same oil as *Raphanus sativus.*

Nasturtium officinale, *R. Br.*—The Water-cress is a native of Northern India, and is largely cultivated in many parts of the country. As a salad it has from time immemorial been held in esteem on account of its appetizing and antiscorbutic properties.

Cardamine pratensis *Linn.*—The Cuckoo-flower or Ladies-smock occurs in Hussora, and has properties similar to *Nasturtium officinale.* The same may be said of the several species of Farsetia which grow in the Punjab.

Eruca sativa, *Lam.*—The Rocket is cultivated in Northern and Central India, and has similar properties, but is more acrid; it is the εὔζωμον (good brothmaker) of the Greeks and Eruca of the Latins. The Arabians call it جرجير (Jarjir) and the Persians ايهقان (Eihukan). The Mahometans say that if a sour Pomegranate is watered with its juice, the fruit will become sweet.

The medicinal action of these Cruciferous plants resembles that of Mustard.

CAPPARIDEÆ.

CLEOME VISCOSA, *Linn.*

Fig.—*Wight Ic., t. 2; Rheede ix., Hort. Mal. ix., t.* 23. Sticky Cleome (*Eng.*), Herbe puante, Brede puante (*Fr.*).

Hab.—Tropical India and other warm climates. The plant and seeds.

Vernacular.—Húlhúl, Húrhúr (*Hind.*), Húrhúriá (*Beng.*), Kanphúti, Pivala-tilávana (*Mar.*), Nai-vela..(*Tam.*), Kukka-váminta (*Tel.*), Hucha sásavi (*Can.*).

History, Uses, &c.—This common weed on cultivated ground appears to have been long in use in India as a domestic remedy; it is called in Sanskrit Adityabhaktá and Arkakánta. Ainslie says:—"The small compressed, netted surfaced, hottish tasted seeds have got the Tamool name of Nahi Kud-dághoo, or 'dog's mustard,' and are considered by the Vytians as anthelmintic and carminative; they are administered in the quantity of about a tea-spoonful twice daily." The juice of the leaves, Rheede says, "is useful in deafness poured into the ears." This account agrees with the way in which the plant is used at the present time, the juice mixed with oil being a popular remedy for purulent discharges from the ear; hence the name Kánphúti.* It is the *Herbe-puante* or *Brede-puante* of the French Settlements in the East. Descourtilz says that when crushed and applied to the skin it causes much redness and even vesication. Given internally it is sudorific; when cooked it loses its acrid properties. Rumphius gives a similar account of its properties, and says the Portuguese call it Bredo Mamma.

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* The juice of plants was used in this way by the Greeks and Romans. Scrib. Larg. Comp. 39. Ad auriculæ et tumorem et dolorem sine ulcere prodest herbæ urceolaris, aut cucurbitæ ramentorum succus tepens per strigilem in foramen auris dolentis infusus.

Description.—An annual weed from 1 to 3 feet high; leaves 3 to 5 foliolate, leaflets obovate; flowers yellow; the whole plant pubescent and extremely viscid; many of the hairs are surmounted by a round gland, from which a reddish viscid secretion exudes; the plant has a powerful odour like black currants. The capsules are from 2 to 3½ inches long, striated, pubescent, tapering towards the point, which is surmounted by the style; the seeds are dark brown or nearly black, reniform, and granular, about the size of black mustard seed; the leaves have a pungent flavour, and the seed a feeble taste of mustard.

GYNANDROPSIS PENTAPHYLLA, *DC.*

Fig.—*Rheede, Hort. Mal. ix., t.* 24.

Hab.—India and all tropical countries. The plant and seeds.

Vernacular.—Húrhúr, Húlhúl, Karaila (*Hind.*), Hurhuriá (*Beng.*), Váminta (*Tel.*), Tilávana, Máblí (*Mar.*), Vela, Taivela (*Tam.*), Waila (*Cing.*).

History, Uses, &c.—The five-leaved Cleome, as it was formerly called, has been long known as a domestic remedy by the Hindus; it is called in Sanskrit Surjavarta and Arka-pushpika, and is noticed by Ainslie, who says, "That the small numerous, warmish kidney formed black seeds, as well as leaves of this plant, are administered in decoction in convulsive affections and typhus fever, to the quantity of half a teacup full twice daily." The natives regard it as having much the same properties as *Cleome viscosa.* In the French colonies and in the Nilgiris it is used as a sudorific. In Pudukota the leaves are applied to boils to prevent the formation of pus. Wight (*Ill. I., p.* 34) says that the bruised leaves are rubefacient and vesicant.

Description.—A common plant on cultivated ground; leaves 5-foliolate, with obovate leaflets; flowers white or

purplish, in glutinous racemes, bracts 3-foliolate; stamens very long, purple; capsules 2 to 4 inches long, tapering towards the point, which is surmounted by the style, striated, pubescent. The whole plant is viscid and covered thickly with glandular hairs; it has a strong peculiar odour like the black currant leaf. The seeds are black, of the same shape and size as those of *Cleome viscosa,* but rougher; they have a very faint flavour of mustard.

Chemical composition.—These plants when crushed in the fresh state develop an acrid volatile oil having the properties of garlic or mustard oil. The dried plants exhausted by alcohol yield a deep green tincture which on evaporation leaves a brown soft resin which has no irritant action when applied to the skin.

CRATÆVA RELGIOSA, *Forst., var. Nurvala.*

Fig.—*Rheede, Hort. Mal. iii., t.* 42. Holy Garlick Pear (*Eng.*), Tapier (*Fr.*).

Vernacular.—Brarna, Bilasi, Bila (*Hind.*), Barun, Tikoshak (*Beng.*), Maralingam (*Tam.*), Nirvala (*Can.*), Uskia, Urumatti (*Tel.*), Vayavarna, Haravarna, Rámala, Karvan (*Mar.*).

Hab.—Malabar, Canara. Cultivated elsewhere. The leaves and bark.

History, Uses, &c.—This small tree is a native of Malabar and Canara, Tropical Africa, and the Society Islands; it is also found planted about temples and Mahometan tombs in many parts of India. It is worthy of remark that this tree is found planted near tombs in several different parts of the world. The Sanskrit names are Varuna and Asmarighna (lithontriptic). Mr. U. C. Dutt gives the following summary of its properties as described in Sanskrit works:—"It is said to promote the appetite, increase the secretion of the bile, act as a laxative, and remove disorders of the urinary organs. In calculous affections it is used in a great variety of forms; thus a simple decoction of the bark may be given with the

addition of treacle. A compound decoction is prepared along with equal parts of *Tribulus terrestris* and ginger, and is administered with the addition of Yavakshára (impure carbonate of potash) and honey. A compound powder, *Varunádya churna,* is prepared as follows :—A solution of the ashes of *Varuná* is made; this solution is boiled with the addition of the bark in powder and Yavakshárá till the water is entirely evaporated, the resulting powder is given in ascites, calculus, enlargements of the abdominal viscera, and affections of the bladder and uterus. A confection, called *Varunádya guda,* is prepared by adding to the fluid extract of the bark, treacle, and a number of diuretic and aromatic substances." The leaves are used as a remedy for swelling of the feet, and a burning sensation in the soles of the feet, a common complaint of a somewhat obscure nature ; they are also cooked and eaten as a vegetable to reduce corpulence. The leaf-juice is given in rheumatism in the Concan in doses of ½ to 3 tolas mixed with cocoanut juice and *ghi.* In caries of the bones of the nose the leaf is smoked and the smoke exhaled through the nose. The bark and leaf pounded and tied in a cloth are used as a fomentation in rheumatism. In physiological action this bark resembles Caper bark. (*See next article.*) A tincture has been found to be an excellent emulsifying agent.

Description.—Leaves 3-foliolate, on long petioles, leaflets lanceolate acuminate, thin, smooth, upper surface dark green, under surface of a lighter colour, about 8 inches long and 3 inches broad. When bruised they have a disagreeable smell, something like Hellebore ; taste slightly bitter and very pungent, causing a tingling sensation in the tongue, not aromatic. The bark is grey externally, and minutely fissured, thick; fracture short; beneath the grey epidermis is a green layer, substance white ; a transverse section shows numerous yellow specks, which when examined with a lens, are seen to be bundles of very large stone cells. The taste is faintly bitter.

Chemical composition.—The bark contains saponin, or a principle similar to it.

CAPPARIS SPINOSA, *Linn.*

Fig.—*Var. 2, rupestris, Sibth., Flor. Græc., t.* 487. *Var.* 3, *vulgaris, Royle, Illus.* 73. *Var.* 4, *leucophylla, Deless. Ic. Sel. iii., t.* 10. Caper plant (*Eng.*), Caprier commun (*Fr.*).

Hab.—Europe, Asia, Africa, &c. The bark of the root.

Vernacular.—Kabar (*Arab.*).

History, Uses, &c.—This plant is widely distributed, being found in Afghanistan, West Asia, Europe, North Africa, Australia, and the Sandwich Islands. The common Indian and Oriental form, Var. 3 of Hooker's *Flora of British India* grows on hilly ground in many parts of India. Caper bark does not appear to have been known as a medicine to the Hindus until introduced by the Mahometans, but the fruits of *C. sepiaria, Linn.* (Kákádani), and of *C. aphylla, Roth.* (Karira), are mentioned by Sanskrit writers. Capparis is mentioned by both Greek and Latin writers,* and its medicinal properties were probably made known to the Arabs through them. The Syrian name is Kabár and the Turkish Kabarish; in Persia it is called Kabár and Kárak. The author of the Makhzan-el-Adwiya gives a good description of the plant, and says that the root bark is the most active part, and generally used. He considers it to be hot and dry, and to act as a detergent and astringent, expelling cold humors; it is therefore recommended in palsy, dropsy, and gouty and rheumatic affections; the juice of the fresh plant is directed to be dropped into the ear to kill worms, just as Cleome juice is used in India; all parts of the plant are said to have a stimulating and astringent effect when applied externally. Ainslie mentions the drug as an imported article, and notices its use as an external application to malignant ulcers. The physiological action of Caper bark is very similar to that of Senega, and depends upon the presence in it of a principle similar to, if not identical with, saponin (*see Saponaria Vaccaria*). The

* Dios. ii., 164. καππαρις or κάππαρι Theophr. H. P. i. 6; iii. 3; vi. 3, 5; vii. 8; Plin. 13, 44; 20, 59. Cels. 4, 9.

fresh plant develops a volatile oil having the properties of garlic oil.

Description.—Caper root bark occurs in half quills several inches in length; it is very thick and transversely fissured ; the external surface is gray, the internal white, taste bitter and pungent.

Chemical composition.—The root bark, according to Rochleder and Blas, contains a neutral bitter principle of sharp irritating taste, resembling senegin. The flower buds distilled with water yield a distillate having an alliaceous odour. After they have been washed with cold water, hot water extracts from them capric acid (C^{10} H^{20} O^{2}), and a gelatinous substance of the pectin group ; capric acid is sometimes found deposited on the calices of the buds in white specks having the appearance of wax. (*Watts' Dict. of Chem.*) Förster has isolated a glucoside from the plant which yields, on boiling with sulphuric acid, isodulcite, and a colouring matter similar to quercetin. Similar glucosides were also found in *Sophora japonica* and *Ruta graveolens.* (*Ding. Polytech. Journ.*, 245, 48 ; *Year-Book Pharm.*, 1883, *p.* 241.)

Commerce.—The drug is imported *via* the Persian Gulf. Value, Re. ¼ per lb.

The root of **C. zeylanica,** *Linn.*, **C. acuminata,** *Roxb.*, *Vern.* Kálu-kera (*Beng.*), Paliki (*Tel.*), Waghanti (*Mar.*), Govindphal (*Hind.*), Authúndi-kai (*Tam.*), is reputed to be a cooling medicine.

The young shoots of **C. aphylla,** *Roth.*, *Vern.* Karil, and of **C. horrida,** *Linn. f.*, *Vern.* Ardanda, are applied medicinally as a counter-irritant. The unripe fruits of both species are used as a pickle with pepper, mustard and oil. In Puducotta the fruits of **C. grandiflora,** *Wall.*, are pickled ; its Tamil name is Killacchedi.

CADABA TRIFOLIATA, *W. & A.*

Fig.—*Hook., Bot. Misc.* 296; *Suppl. t.* 37.

Hab.—Carnatic, Ceylon.

C. INDICA, *Lamk.*

Fig.—*Burm. Ind. t.* 46, *f.* 3.

Hab.—W. Peninsula.

C. FARINOSA, *Forsk.*

Fig.—*Deless., Ic. Sel. iii.*, t. 8.

Hab.—Punjab, Sind, Arabia, Africa.

Vernacular.—*C. trifoliata*, Viluthee, Maunthakkooroonthu (*Tam.*), Checkonadi (*Tel.*). *C. indica*, Velivi (*Tam.*). *C. farinosa*, Asal, Sarah (*Arab.*).

History, Uses, &c.—The genus derives its title from Kadhab (قظيب or قضب), an Arab name for the *C. rotundifolia* of Forskal, who mentions another species (*C. farinosa*) as medicinal. He says: "Usus antitoxicus: dum rami recentes et minores masticantur, vel pulveris forma eduntur." The latter plant, under the name of سرح is described by Az, from information given to him by an Arab of the desert, as a shrub with a dusty colour, not so tall as the tamarisk (أثل), with small leaves and lank branches or twigs; and always growing slanting. A species of Cadaba is very common in Socotra, and Balfour suggests that the village of Kadhab on the northern shores of that island may have taken its name from this plant, which grows abundantly on the plain in its vicinity.

In Pudukota the root and leaves of *C. indica* are used in decoction as an anthelmintic, and the juice of the leaves of *C. trifoliata* is given to children suffering from indigestion.

According to P. S. Moocooswamy of Tanjore the trifoliate Cadaba is common on the sites of ruined temples and other buildings, and the leaves are considered to be purgative, emmenagogue, antisyphilitic, anthelmintic and antiphlogistic; they are much employed in preparing medicated oils. As a purgative half an ounce of the leaves may be used in decoction like senna with sulphate of magnesia, but the natives usually administer them with myrobalans and ginger; given in this manner they appear to have much the same action as senna. In combination with castor-oil and turmeric the decoction is prescribed by native doctors in amenorrhœa and dysmenorrhœa. The boiled leaves are eaten as an anthelmintic, and are applied externally to rheumatic joints; together with the leaves of *Odina Wodier* and child's urine they are applied as a poultice to phlegmons to promote suppuration. The pods are boiled, dried, soaked in buttermilk, again dried, and fried with melted butter (*ghi*) as a vegetable. The medicinal properties of the root are similar to those of the leaves. *C. trifoliata* is supposed to be the Balaya of Sanskrit writers.

Description.—*C. trifoliata* has palmately 3-foliolate leaves, with oblong or lanceolate leaflets about 2 inches in length. The leaves of *C. indica* are simple ovate or oblong acute or mucronate, from 1 to 1½ inches long. The leaves of *C. farinosa* are hoary, ovate or oblong obtuse and seldom an inch in length.

Chemical composition.—The ethereal and alcoholic extracts of the leaves of *Cadaba indica* yield to acidulated water a somewhat bitter alkaloid giving crystallisable salts when evaporated. No tannin is present, but an organic acid precipitable from a concentrated aqueous extract by an equal volume of alcohol. This acid is combined as a calcium salt, and yields when burnt 21 per cent. of carbonate. Another acid of a dark colour is found in the same extract; it is precipitated by four volumes of spirit, and resembles in some of its reactions cathartic acid.

The leaves contain a considerable quantity of nitrates, recognised by their slight deflagration when burning; and by showing the peculiar ring with the sulphuric acid and iron test, even in the cold infusion.

The dried and powdered leaves after complete combustion leave 16·5 per cent. of white ash, of which more than oue-half is soluble in water, and consists of alkaline chlorides, carbonates and sulphates.

VIOLACEÆ.

IONIDIUM SUFFRUTICOSUM, *Ging.*

Fig.—*Wight. Ill., t.* 19; *Ic., t.* 308.

Hab.—Tropical Asia, Africa and Australia. The plant.

Vernacular.—Ratanpurs (*Hind., Mar.*), Orilatamaray (*Tam.*), Purusharatanam (*Tel.*), Nunbora (*Beng.*).

History, Uses, &c.—In Southern India this plant is considered to be one of the two kinds of Chárati mentioned by Sanskrit writers, a synonym for which is Padma-chariní. The native physicians regard it as a tonic and diuretic, and prepare a *paka* or confection of the whole plant. Twenty to sixty grains of the plant are administered in each dose.

Rheede and Ainslie mention Chárati. According to the latter writer, the leaves and tender stalks are demulcent and are used by the natives in decoction and electuary, and also employed in conjunction with some mild oil, in preparing a cooling liniment for the head. The plant is more or less known for its medicinal properties from Agra to Ceylon, and is often used in Southern India as a demulcent in gonorrhœa, and its demulcent properties are known in N. S. Wales, where the plant is common.

Description.—The drug as sold in the shops consists of the root and some of the leafy portion of the plant attached to it; the roots are yellowish-white, 3 to 4 inches in length,

about $\frac{1}{12}$th of inch in diameter at the upper part, gradually tapering downwards, woody and tough, and covered with a corky bark. Stems woody; leaves small, alternate, sub-sessile, lanceolate. Taste mucilaginous.

Chemical composition.—The root contains an alkaloid soluble in ether and alcohol, not easily crystallized; its solution in the form of a salt, which it readily forms with the mineral and vegetable acids, is precipitated by potassio-mercuric iodide, iodine in potassium iodide, tannin and the alkalies. It also contains quercitrin, allied to the viola-quercitrin of Mandelin; and another colouring matter soluble in water, but insoluble in amylic alcohol; an acid resin; and a quantity of mucilage and oxalates.

VIOLA ODORATA, *Linn.*

Fig.—*Bentl. and Trim., t.* 25. March Violet (*Eng.*), Violette odorante (*Fr.*).

Hab.—The north temperate zone. The plants and flowers.

Vernacular.—Banafshah (*Pers., Hind., Bomb.*).

History, Uses, &c.—The Greeks made use of this herb as a medicine,* and from them and their works the Mahometans probably became acquainted with its properties; it does not appear to have been used by the early Hindu physicians. A long account of its properties will be found in most Arabic and Persian works on Materia Medica; it is generally considered cold and moist, and is especially valued as a diuretic and expectorant, and as a purgative in bilious affections; it is seldom given alone, but is prescribed along with other drugs, which also have an aperient action, such as tamarinds, myrobalans, &c. The diseases in which Banafshah

* Dios. iv. 117. Viola, Latin, digammated from ἴον Plin. 21, 14, 76. Theophrastus H. P. VI., 6, 7, mentions ἴον the flower and ἰωνια the plant, of which there are two kinds, black and white.

is recommended are too numerous to be mentioned here; suffice it to say that they are generally those in which a cooling treatment is thought to be indicated by the hakims. The root has been tried by European medical men in India as a substitute for Ipecacuanha, but according to the Bengal Dispensatory, without satisfactory results. Native doctors consider the purple-flowered variety to be the best; they use the flowers separately, and also the entire plant.

Description.—The root is as thick as a crow quill, very crooked, and furnished with a number of thin radicles; it has a spongy bark, and a hard woody meditullium; the colour is pale yellow; odour and taste not peculiar.

Chemical composition.—The flowers are said to contain, besides colouring matter, slight traces of a volatile oil, three acids, one red and the other colourless, and salicylic acid; an emetic principle called violin, probably identical with emetine; violaquercitrin in close relation to, but not identical with, quercitrin or rutin (*Mandelin*); and sugar, &c. The colouring matter of the flowers is easily turned red by acids, and green by alkalies, and hence the syrup of violets was formerly used as a reagent. The colourless acid called violenic acid by Peretti, is said to crystallize in silky needles, to be soluble in water, alcohol, and ether, and to form yellow salts which stain the skin. According to Boullay, all parts of the plant contain violin. The ash of *V. calaminaris* (yellow violet) growing in Rhenish-Prussia in soil in which zinc is present, has been found to contain that metal.

Commerce.—Violet flowers (Gul-i-Banafshah) and the plant (Kashmiri Banafshah) are the two forms of this drug met with in the Indian markets; the first is generally imported from Persia, and consists of the flowers of the purple violet; the second comes from Cashmere, and is the whole plant in flower; it seems to be a white or yellow flowered variety. In Northern India *Viola cinerea, Boiss.*, and *V. serpens, Wall.*, are used as substitutes for *V. odorata,* and are called Banafsheh.

BIXINEÆ.

GYNOCARDIA ODORATA, *R. Br.*

Fig.—*Bentl. and Trim., t.* 28.

Hab.—Sikkim and Khasia hills to Chittagong, Rangoon and Tenasserim. The seeds.

Vernacular.—Chaulmugra (*Hind., Bomb.*), Tùk-kung (*Lepcha.*).

History, Uses, &c.—We know very little of the history of this drug, but it seems that the inhabitants of South Eastern Asia have for a long time been in the habit of using the seeds of this and of another nearly allied species as a remedy for leprosy. The fruits grow upon the stems and main branches of the tree. The hill tribes in Sikkim use the pulp to poison fish, and after boiling it with water, as a food. The bark is said to be used as a febrifuge; it contains tannin, and its infusion has the odour of essential oil of bitter almonds. There has lately been a demand for it from the Mauritius. Hanbury has pointed out that a seed very similar to Chaulmugra is exported to China from Siam, under the name of *Lukrabo,* and that it differs from Chaulmugra in having a stronger testa. In the Makhzan-el-Adwiya there is a short notice of the seeds under the name of *Chawul mungri;* their use in leprosy and other skin diseases is mentioned both as an internal and external remedy. In native practise the oil is administered mixed with clarified butter; this mixture is of a brownish yellow colour, and of the consistence of a soft ointment; it is often adulterated. Roxburgh, and the authors of the Bengal Dispensatory, briefly notice Chaulmugra, but of late years it has become better known to Europeans, and has been extensively used in many parts of India with a favourable result. In the *Indian Annals of Medical Science,* April, 1856, it was brought to notice as a remedy for secondary syphilis. It was first given as a remedy for phthisis and scrofula by Dr.

R. Jones of Calcutta, in doses of six grains three times a day. In 1868 it was made officinal in the Pharmacopœia of India, where an ointment is directed to be made from the pounded kernels mixed with Ung. Simplex. Within the last few years the oil has been used in several of the London hospitals as a remedy for stiff joints caused by rheumatism, being rubbed in, and also given internally in doses of 3 to 4 minims three times a day after meals; the dose may be gradually increased. For children 1 to 2 minims once a day is sufficient; it may be combined with cod-liver oil. Dr. Young, of Florence, has used the oil with advantage in macular and anæsthetic leprosy; during treatment bronchial affections disappeared. In America it has been used as a remedy for sprains and bruises and for sciatica; over-doses (10 minims three times a day) cause vomiting and purging with loss of appetite, but all people are not equally affected by the drug. In chest affections and phthisis it may be rubbed into the chest with advantage. People taking it should live generously; native Indian doctors recommend abstinence from meat, sweets, spices and acids during its use. Dr. Wyndham Cottle writes to the *British Medical Journal* on Chaulmugra oil and its active principle, Gynocardic acid, as internal and external remedies in various forms of skin disease. Gynocardic acid he finds preferable for several reasons, as it rarely produces nausea, can easily be given in the form of pills, and is more uniform. Both the oil and gynocardic acid are used either as external or internal remedies, the oil being taken best in *perles*; and the oil and the acid best applied as ointments in combination with vaseline. Dr Cottle seems to have found these medicines most serviceable as local applications in eczema. In eczema of the face, and when it shows itself in dry patches, he has found an ointment of gynocardic acid of from 15 to 25 grains to the ounce of vaseline, almost a specific, when most of the ordinary applications in use only served to aggravate the local mischief. The ointment should be applied three or four times daily, so as to keep the affected parts lubricated with it. Again, in eczema of the hands, such an ointment is the most generally useful application with which he is acquainted. In

the acute form of this disease, or where there is much discharge, the good effects following the use of Chaulmugra oil, or gynocardic acid, locally applied, are not so marked. For internal administration it is well to begin with about four minims of the oil, or half a grain of the acid, taken after food, twice or thrice daily, and gradually increased to from half a drachm to one drachm of the oil, or one to three grains of the acid. An aperient should be given at the same time if necessary. The oil may be given in emulsion; it is convenient to have the gynocardic acid made into pills containing half a grain of the acid, with three grains of extract of gentian, extract of hops, or conserve of roses. To commence, one such pill may be given thrice daily. The amount may be gradually increased to three or four pills for each dose. The writer adds that the constitutional effects of the drug may be produced by inunction, and he suggests that a soap in which gynocardic acid was incorporated would probably possess much of the soothing and remedial influences of the gynocardic acid, and prove useful in the treatment of many forms of skin disease.

Description.—The fruit is globular, from 3 to 5 inches in diameter, with a thick hard rough rind, and contains a number of irregularly ovoid seeds in a scanty pulp. The seeds are from 1 to 1¼ inch long, more or less angular or flattened by mutual pressure; they average about 35 grains in weight. The testa is thin, brittle, smooth and of a dull grey colour; the albumen is copious, white when fresh, but brown in the dried seeds and oily, and encloses a pair of large, plain, leafy heart-shaped cotyledons with a stout radicle; the odour of the seed is nauseous and peculiar.

Microscopic structure.—The testa consists of an outer and an inner layer of stone cells placed parallel to the surface of the seed, the space between them being occupied by two or three rows of similar cells, the long axes of which are arranged nearly at right angles to those of the exterior cells. (*Moeller.*) The albumen exhibits large angular cells containing fatty oil, masses of albuminous matter, and tufted crystals. Starch is not present.

Chemical composition.—In the hydraulic press the seeds yield from 25 to 30 per cent. of oil, to ether 51·5 per cent. The oil is sherry-yellow. Sp. gr. ·9450 at 85° F., and turns green with the sulphuric acid test (*cf. Phar. Journ., March* 25, 1876), it deposits in cold weather a quantity of crystalline fat. A chemical examination of the oil, by Moss, has shown that the existence of any alkaloidal substance is doubtful, at least so far as to account for any medicinal efficacy. He finds it to contain a peculiar fatty acid, gynocardic 11·7 per cent., associated with palmitic acid 60·0 per cent., hypogœic acid 4·0 per cent., and cocinic acid 2·3 per cent., in combination with glyceryl as fats, and the two former in the free state as well. Gynocardic acid crystallizes in yellowish plates, melts at 85° F., has an acrid burning taste, probable formula $C^{14} H^{24} O^2$; it strikes a green colour with sulphuric acid. Moss also found that palm oil gave a similar reaction. The chemistry of Chaulmugra has recently (1885) been investigated by E. Heckel and F. Schlagdenhauffen, who consider the following test to be characteristic of the oil. They direct the oil to be mixed with an ethereal solution of ferric chloride, and the mixture to be evaporated until the oil becomes of a dirty green colour; it is then allowed to cool, and a few drops of sulphuric acid are added, which produce a fine greenish-blue colour. The colouring matter may be dissolved out by chloroform, with which it forms a dichroic solution like that of chlorophyll. This solution gives a deep absorption band extending from 40° to 70° of the scale (the sodium-ray coinciding with 50°). In proportion as the solution is diluted the black band becomes fainter, until, with a very weak solution, only a narrow very pale band can be seen, extending between 40° and 48° of the scale.

The following is the result of the analysis of the seeds:—

Soluble in water	9·175	Glucose	0· 50
		Fixed salts	1· 114
		Albumenoid matters	1·2675
		Colouring matters, &c.	6·2935

Fatty matters soluble in Petroleum	30·120	....	30· 120
Fatty matters soluble in Chloroform ...	0·505	....	0· 505
Soluble in methylic alcohol..............	5·405	Glucose..................	0· 54
		Albumenoid matters...	0·4206
		Fixed salts................	0· 090
		Non-nitrogenized organic matters......	4·3544
Residue insoluble in methylic alcohol.	49·009	Albumenoid matters.	23·8740
		Fixed salts..............	4· 845
		Cellulose and other non-nitrogenized matters............	20· 290
Moisture....................	5·786		
	100·000		

—(*Journ. de Phar. et de Chim.*, *April* 1*st*, 1885.)

Commerce.—The seeds are collected in the Lower Himalayas in December and are brought to Calcutta. Value about Rs. 12 per Bengal maund of 80 lbs. Of late years a false Chaulmugra seed has occasionally found its way to India. It has a thicker shell and yields less oil.

False Chaulmugra, Lukrabo or Ta-Fung-Tsze.—The following article by Mr. E. M. Holmes appeared in the *Pharm. Journal*, 3rd Ser. XV., 41:—"In the interesting papers on 'Chinese Materia Medica,' by the late Daniel Hanbury, published in the *Pharmaceutical Journal* [2], Vol. III., a seed is described and illustrated under the name of *ta-fung-tsze*, which he conjectured to be allied to *chaulmugra*. This seed is largely used in China in skin diseases and leprosy, and is said to have been employed in that country for at least 300 years, since the tree affording the seed is figured in the old Chinese herbal 'Puntsaou,' published A. D. 1596. The tree, however, has up to the present time been unknown to botanists. The *ta-fung-tsze* is still an article of considerable commerce, figuring in the Consular Blue-Books under Chinese imports by the

name of *lukrabo*. As much as 48 piculs (6,400 lbs.) of the seed were exported from Bankok to China in 1871. It is also exported thither from Saigon, in Cochin-China. The seed in question is about half the length of *chaulmugra* seed, but of equal diameter. The shell is thicker and harder, and at one end is marked with a few radiating slightly raised ridges, whereas that of *chaulmugra* is quite smooth.

"Dr. Porter Smith, in his 'Chinese Materia Medica' (1871), p. 140, describes these seeds under the name of *lucrubau*, and he also considers them as a variety of *chaulmugra*. He states that they are described in Chinese books as being good for leprosy, lepra, itch, pityriasis, psoriasis, syphilis, lipoma, vermes, and chaps on the back of the hands, and that calomel and the seeds of *Robinia amara* are used with the lucrubau, both externally and internally, in the treatment of leprosy. In the province of Hupeh the seeds are in great repute as a remedy for parasitic pediculi and the itch insect. In Soubeiran's " Matière Médicale chez les Chinois" (p. 221), the seeds are erroneously referred to *Gynocardia odorata*.

"In the Kew Report 1878, p. 30, the seeds under the name of *dai-phong-tu*, are said to be used in Saigon as a vermifuge after the extraction of the oil. It is added that M. Pierre has successfully raised some seeds of the plant, and refers it to the genus *Hydnocarpus*. The species, however, is not mentioned in the Kew Report, and no further information has appeared in it upon this point in subsequent years. Having had a specimen of the *lukrabo* seed in the Museum of the Pharmaceutical Society for some years—without a specific name—the author recently wrote to M. Pierre for information as to the species yielding the seed. In response that gentleman forwarded for the Society's herbarium a specimen of the plant with flowers and seeds, and the following interesting statement:—"It is a new species, which I have named *Hydnocarpus anthelmintica*, *Pierre*. It is very nearly allied to *H. alpina*, *Wight*, p. 940, but its leaves are more

linear-oblong. The scales opposite to the petals are less long and more ciliated, the stigma is furrowed in its whole extent, and is only toothed towards the extremity of its reflexed margin, while in *H. alpina* it is furnished with large lobes. The male-flower contains a rudimentary ovary; in the female flower this is pyramidal. The seeds are used as a vermifuge by the Annamites. The names given in Annam to the plant are *dai-phong-tu* and *thaoc-phu-tu*. The specimen sent was gathered in the province of Bien Hoa, in Southern Cochin-China."

HYDNOCARPUS WIGHTIANA, *Blume.*

Fig.—*Wight, Ill. i., t.* 16; *Rheede, Hort. Mal. i., t.* 36. Jungle almond (*Eng.*).

Hab.—Western Peninsula, South Concan to Travancore. The seeds.

Vernacular.—Kadu-kavatha (*Mar.*), Niradimutu (*Tam.*), Niradivittulu (*Tel.*), Tamana, Maravetti (*Mal.*).

History, Uses, &c.—All that we know of the history of this tree is that the seeds have long been used as a domestic remedy upon the Western Coast in certain obstinate skin diseases, and that the oil is expressed by the poorer classes for burning, and for use as a medicine. In scabby eruptions the oil mixed with an equal portion of *Jatropha Curcas* oil, sulphur, camphor and limejuice, is rubbed in. For scald head equal parts of the oil and lime-water are used as a liniment. The oil has also a reputation in the Concan as a remedy for *Bursati* in horses. Rheede tells us that it relieves rheumatic pains, is used in skin diseases, and mixed with ashes is applied to abscesses, sore eyes and wounds infected with maggots. (*Hort. Mal.* i., 36.) In Travancore half-teaspoonful doses are given in leprous affections, and it is beaten up with the kernels and shells of castor seeds as a remedy for itch. Latterly the oil has been brought to the notice of

Europeans as a substitute for Chaulmugra, and has been used in the Bombay Presidency with satisfactory results.

Description.—The fruit is globose, about the size of an apple; it has a rough, thick, brown rind, externally suberous, internally woody, which is generally studded with large tubercles, but non-tubercular fruit may be found on most trees. Within are from ten to twenty obtusely angular seeds, ¾ of an inch in length, embedded in a scanty white pulp firmly adherent to the thin black testa. When the pulp is scraped off, the outer surface of the testa is seen to be rough and striated by shallow longitudinal grooves; it has not the prominent ridges of *H. venenata, Gartn. Fruct. i., t.* 60. Inside the shell is a copious oily albumen, containing two large, plain, heart-shaped, leafy cotyledons like those of Chaulmugra. The albumen, when fresh is white, but turns of a dark brown colour in the dry seeds; the odour resembles that of Chaulmugra.

Microscopic structure.—The testa and albumen present the same appearance as those of the Chaulmugra seed.

Chemical composition.—The seeds contain about 44 per cent. of oil, which has an odour and colour similar to that of Chaulmugra oil; and a sp. gr. of 85° F. of ·9482. A large quantity in stock for more than 12 months did not give any crystalline fatty deposit. Treated with sulphuric acid the oil affords the gynocardic acid reaction, but in a less degree than Chaulmugra.

Commerce.—The seeds are not an article of trade, but if ordered, may be obtained at about half the price of those of Chaulmugra. The oil has been sold in Madras at As. 2-6 per seer.

BIXA ORELLANA, *Linn.*

Fig.—*Rumph., Amb II.,* 19; *Bot. Mag.* 1456. Annatto bush (*Eng.*), Rocouyer (*Fr.*).

Hab.—America. Cultivated in India.

Vernacular.—Sendri, Kesri, Kèsar-bondi (*Mar.*), Nutkaner (*Beng.*).

History, Uses, &c.—Bixa is the name given to this shrub by the American Indians; the Brazilian name is Urucuara, or the Urucu plant, Urucu being the Brazilian name for the pigment. There are two varieties, one with pink flowers and greenish-yellow fruit.

The plant does not thrive without plenty of sun.

The pigment is prepared by macerating the seeds in water, straining to remove seeds and evaporating to a suitable consistence; the mass is then made into *roll* or *flag Annatto*. The seeds simply dried with the pigment on them are called *Urucu em gros.* Urucu is used by the American Indians as a dye and for colouring food. A hot infusion of the leaves is considered to be a remedy for jaundice. (*U. S. A. Consul's Rep. on Annatto.*) Annatto is also used by Caribs to dye their bodies; and in Europe to colour butter, cheese and varnish. The use of annatto in dyeing cloth is now limited, *aurin,* an aniline dye, being used for the production of orange colours.

The pulp surrounding the seeds is astringent and slightly purgative. (*Roxb.*) The seeds and root are cordial, astringent and febrifuge. (*Rumph.*) The plant thrives in India and is cultivated in many parts of the country. It is the Galuga of Rumphius (II. 28), who notices its use in Amboyna as a paint and dye.

Chemical composition.—The colouring matter contained in the seeds may be obtained in the form of minute red leaflets (Bixin $C^{28} H^{34} O^{5}$) insoluble in water, slightly soluble in alcohol, but easily dissolved by ether.

Bixin dissolves in concentrated sulphuric acid, the solution being of a bright blue colour; diluted with water it yields a green precipitate.

COCHLOSPERMUM GOSSYPIUM, *DC.*

Fig.—*Wight in Hook. Bot. Misc. ii.*, 357; *Suppl.*, *t.* 18. Golden Silk-cotton tree (*Eng.*).

Hab.—Garwhal, Bundelkhund, Behar, Orissa and Deccan. The gum.

Vernacular.—The tree, Pili-kapas (*Hind.*), Tanaku (*Tam.*), Konda-gogu (*Tel.*). The gum, Katíra-i-Hindi (*Pers.*, *Hind.*).

History, Uses, &c.—This tree grows upon dry hilly ground, where it attains a large size. The flowers are large and of a golden yellow colour, and appear in March and April, when the tree is destitute of leaves; the capsule is the size of a goose egg and filled with cotton; the seeds kidney-shaped or cochleate, with a hard testa. The gum is used in the Upper Provinces as a substitute for Tragacanth. The Katíra, or more correctly Kathíra of Arabic and Persian writers on Materia Medica, is the true Tragacanth, and the name has been transferred to the gum of this tree by the Mahometan settlers in India. In Celebe the seeds are roasted and eaten; they are sweet and oily; the young leaves are used to make a cooling wash for the hair. (*Rumph.*, I. 80.) In Bombay the gum of *Sterculia urens*, called 'Karai gond' by the Guzerathi shopkeepers, is used as country Tragacanth, and is sold by Mussalman druggists as Katíra.

Description.—White or yellowish, generally in large vermicular pieces, transversely fissured, and showing a tendency to split up into flat scales, sometimes in large flat pieces like Tragacanth; when moistened it swells up into a bulky transparent jelly, which may be diffused in a large quantity of water, but is only very sparingly soluble. Its solution in water is neutral; the portion insoluble in water yields with alkalies a thick mucilage of a pinkish colour, which, according to Mitchell (1880), is not precipitated by acids.

FLACOURTIA CATAPHRACTA, *Roxb.*

Fig.—*Rumph. Amb., Cap.* 43, *p.* 38; *XIX., t.* 1, 2. Many-spined Flacourtia (*Eng.*), Prunier d' Inde (*Fr.*).

Hab.—India. Commonly cultivated. The fruit.

Vernacular.—Pani-aonvala (*Hind.*), Jaggam (*Port.*), Tambat (*Mar.*), Paniála (*Beng.*).

History, Uses, &c.—This is the Práchinámalaka of Sanskrit writers; it appears to be doubtful whether it is a native of India, as it is generally met with in a cultivated state. The author of the Makhzan-el-Adwiya speaks of two kinds of Paniála, one cultivated and the other wild. He describes the fruit as being like a plum, but differing from it in having 5 to 6 stones instead of one, and suggests that this difference may be due to the impurity of the atmosphere of Bengal operating upon the plum tree of Persia. The Bombay name Jaggam appears to be a corruption of Jangomas. Dalzell and Gibson consider the tree to be truly wild in the Southern Concan. The fruit is recommended as useful in bilious conditions; and like most acid fruits, it no doubt relieves the nausea and checks purging. It is the size of a plum, purple, and acid; indehiscent, with a hard endocarp; seeds 5 to 6, obovoid; testa coriaceous; cotyledons orbicular.

F. Ramontchi, L'Herit., the Mauritius plum, and *F. sepiaria, Roxb.*, have similar properties. None of these plants are of any importance medicinally, nor are they worth cultivating as fruit trees. Their bark and leaves are acid and astringent, and are sometimes used by the natives both internally and externally. The leaves of *F. Cataphracta* are oblong or oblong-lanceolate, long-acuminate, glabrous, crenate-serrate, 2—4 by 1—1¾ inches; they have a short petiole from ¼ to ½ an inch in length. An oil is extracted from the seeds on the Malabar Coast.

PITTOSPOREÆ.

PITTOSPORUM FLORIBUNDUM,

W. & A. var.

Hab.—Subtropical Himalaya, Western Peninsula.

Vernacular.—Vehkali, Vikhári, Vehyenti (*Mar.*), Tibiliti (*Nepal.*).

History, Uses, &c.—Little or nothing appears to be known of the medicinal properties of the genus Pittosporum. A variety of *P. floribundum* is common on the Western ghauts and in other mountainous parts of India. The bark is bitter and aromatic, and is said by the natives to possess narcotic properties. It is used as a febrifuge in doses of 5—10 grains; in doses of 20 grains they believe it to be a specific for snake poison. The Marathas on the Ghats call it Vikhari or Vishári, which means "an antidote for poison." Mr. Bajaba Balaji Nené, a Brahmin practitioner of Poona, who first noticed its use among the hill people, informs us that he has given 5—10 grain doses of the dried bark with benefit in chronic bronchitis, and that he finds it to be a good expectorant, but in one or two cases in which it was tried in Bombay, it is said to have given rise to dysenteric symptoms; Mr. Nené, however, informs us that he has not observed its administration to be followed by any such effect. Graham remarks that the cortex fœtidus of Rumphius (vii., 7,) appears to belong to this genus.

Description.—The bark is in single hard quills of various sizes, the external surface is grey and marked by numerous transverse ellipsoid warty prominences, which often form circular rings; the inner surface is very smooth and of a light brown colour when dry; fracture short, granular; odour aromatic and resembling that of caraways; taste sub-aromatic and very bitter. *P. floribundum* is a small tree, branches

often umbelled; leaves lanceolate or oblong-lanceolate, acute or acuminate, margins waved 2—8 by 1—3 inches, glabrous, shining, pale below, coriaceous. Corymbs terminal, branches 1—3 inches, spreading, glabrous or pubescent. Flowers few or numerous, yellow; sepals obtuse or acute, subciliate; style glabrous. Capsules size of a large pea, glabrous, about 6-seeded, opening round the apex; seeds covered with a reddish resinous substance. Graham considers the *P. floribundum* of Western India to be very near to if not identical with *P. undulatum, Vent.*, of N. S. Wales, called by the English colonists Native Laurel and Mock Orange, from the bark of which Baron Mueller and L. Rummel have obtained a bitter glucoside which they have named Pittosporin. (*Cf. Wittstein Org. Const. of Plants.*) The Indian plant yields a similar principle, as well as an aromatic yellow resin or oleo-resin having very tenacious properties.

POLYGALEÆ.

A plant named πολυγαλον was known to the Greeks and Romans, and is mentioned by Dioscorides and Pliny; it is generally identified with the *Polygala vulgaris, Linn.*, the Milkwort of the English and Laitier of the French. Dodoneus calls it "*Flos ambarvallis,*" or, "the flower which goes round the fields," because, says Gerarde, "it doth especially floure in the Crosse or Gang weeke, or Rogation weeke; of which floures the maidens which use in the countries to walk the Procession, do make themselves garlands and nosegays; in English we may call it Crosse-floure, or Procession-floure, Gang-floure, Rogation-floure, and Milkwort." *P. vulgaris* is bitter, acrid, and somewhat aromatic, especially the root; it acts as an expectorant, tonic, and purgative, and still retains a reputation in Europe as an expectorant in chronic bronchial catarrh. Several species of Polygala are used on account of their possessing similar medicinal properties, the best known being the *P. Senega* of America. In the East *P. tenuifolia* is the Yuen-chi of the Chinese. Smith (*Chinese Mat. Med.*, p. 175)

says that the root is brought from Shensi and Honan, and is used in cynanche, cough, and carbuncle, and the leaves in spermatorrhœa. In India, *P. crotalarioides, Ham.* (*Royle Ill. t.* 19. C.), a plant of the temperate Himalaya from Chamba to Sikkim, and of the Khasia mountains, has a reputation as an expectorant.

P. telephioides, *Willd.*, growing in the Western Peninsula, has a similar reputation.

P. chinensis, *Linn.*, is common in pasture lands throughout India in the rainy season. It is called Merádú in Hindi and Négli in Marathi; and is not used medicinally. A species of *Polygala* is the Furfur of the Persians and Lubánat of the Arabians.

Like Senega all these plants owe their medicinal properties to the presence of a substance closely related to, if not identical with, saponin.

CARYOPHYLLEÆ.

SAPONARIA VACCARIA, *Linn.*

Fig.—*Mor. Ox.* 5, 21, 27. *Syn.*—Gypsophila Vaccaria. Perfoliate Soapwort (*Eng.*).

Hab.—Wheat fields throughout India and Central Europe. The root.

Vernacular.—Sábúni (*Hind., Beng.*).

History, Uses, &c.—The root of a plant named *στρουθίον* was used by the Greeks for washing wool on account of its saponaceous qualities. (*Theoph. H. P. vi.* 4, 3; *Dios. II.*, 152.) This root was also used medicinally. (*Hipp. pag. Fœs.* 571, 54; *Dios., II.*, 152.)

The Romans used the same root under the names of Struthium and Radicula. Pliny (19, 18 and 24, 58) tells us that it is diuretic, laxative, and sternutory, and was prescribed

in jaundice, cough, liver, spleen, asthma, and pleurisy; that on account of its supposed detergent action on the uterus, it was called "aureum poculum," and was also applied externally with meal to resolve tumours, &c. Struthium has been identified by some with *S. officinalis, Linn.*, and by others with *Gypsophila Struthium, Linn.*, both of them plants having properties identical with *S. Vaccaria*, which is also a European plant. The Arabs are acquainted with the soapworts under the name of El-sábuniyeh.

Boerhave and the physicians of his time employed *S. officinalis* on account of its supposed resolvent and alterative action in syphilis, Barthez in gout, and Biett for chronic skin diseases. Lebœuf, of Bayonne, was the first to discover the emulsifying properties of saponin and of tinctures of those drugs which contain it, such as Senega, Quillaya, &c.

The physiological action of saponin is that of a powerful sternutatory; injected subcutaneously it greatly irritates the tissues; Pélikan has shown that it exerts upon the motor and sensatory nerves a benumbing action approaching to paralysis. Köhler has observed that it paralyses the motor centres of the nerves of respiration and circulation. According to Schroff it augments the bronchial secretions and acts as a diuretic and purgative. The supposed emmenagogue action of the soapworts has not been proved. As a medicine, saponin has not as yet been tried, but drugs which doubtless owe their activity to its presence have been long in use in India and elsewhere.

Description.—*S. Vaccaria* is a tall, robust, simple or sparingly branched, perfectly glabrous annual, with oblong-acute leaves, and linear-oblong cauline leaves. The flowers are in dichotomous cymes, and of a pink colour. The taste of the entire plant is bitter and saline. The roots are very long and cylindrical, branching, and about the size of a quill, bark externally reddish, thick, and easily separable; internally firm and white.

Chemical composition.—An infusion of the root is blackened by salts of iron, and its decoction froths like soap and water.

The powdered root exhausted with boiling alcohol yields saponin, which is deposited on the cooling of the alcohol. Saponin is a white, amorphous, friable, inodorous substance, having an acrid taste. It is very soluble in water, and forms with it an emulsion. It is insoluble in ether, soluble in weak spirit and in boiling absolute alcohol. Treated with an acid and its solution boiled, saponin is converted into sapogenin and sugar—

$$C^{32} H^{54} O^{18} + 2 H^2 O = C^{14} H^{22} O^2 + 3 C^6 H^{12} O^6.$$

Sapogenin is soluble in alcohol and ether, and crystallizes from the former by slow evaporation in concentric groups of needles. From solution in dilute aqueous potash it is precipitated by stronger potash-ley, as flocculent potassium sapogenin; the solution in alcoholic potash is precipitated by water only when the potash is in excess. When sapogenin is heated with potassium hydrate till decomposition commences, part of it is resolved into acetic acid, butyric acid, and a soft brown substance, and the undecomposed portion when separated by potash melts at 128°, whereas before the treatment with potash it does not liquefy at that temperature. The compound obtained by Fremy from saponin and designated as æsculic acid, is regarded by Rochleder as $C^{26} H^{42} O^{12}$, and its formation is represented by the equation—

$$C^{32} H^{54} O^{18} = C^{26} H^{42} O^{12} + C^6 H^{12} O^6.$$

Christophson (*Archiv. d. Pharm. VI.*, 432, 481), obtained from *Gypsophila Struthium* root 14·59, 15·0, 13·31, and 13·2 per cent. of saponin; and from *Saponaria officinalis* root 4·78 and 5·09 per cent.

DIANTHUS ANATOLICUS, *Boiss.*

Hab.—Western Tibet to Armenia.

Vernacular.—Kanturiyun (*Pers., Ind.*).

History, Uses, &c.—This plant has been introduced into the Materia Medica of the East as a substitute for

Erythræa Centaurium, Pers., the Centaury of the British Flora, which it only resembles in having pink flowers. *D. anatolicus* is a densely-tufted plant, with a much-branched, short, woody stock; stems 6 to 10 inches, very slender, strict, one or more flowered; leaves rigid, slender, with a very thick midrib and margin; bracts with sometimes foliaceous points; calyx teeth subacute; petals rosy, blade small, broad, crenate-toothed. The plant contains a little saponin. It is imported from Persia *viâ* Bombay.

Polycarpæa corymbosa, *Lam., Ill.* 2798; *Wight Ic., t.* 712. A small plant found in many parts of India from the Himalaya to Ceylon, is administered in Pudukota both externally and internally as a remedy for the bites of venomous reptiles. Its Tamil name is Nilaisedachi. It may possibly contain a little saponin, but we have not thought it of sufficient importance to be examined.

PORTULACEÆ.

PORTULACA OLERACEA, *Linn.*

Fig.—*Plant. Grass.* 123; *Rheede, Hort. Mal. x.*, 36. Purslane (*Eng.*), Pourpier potager (*Fr.*).

PORTULACA QUADRIFIDA, *Linn.*

Fig.—*Jacq. Col. II., t.* 17, *f.* 4; *Rheede, Hort. Mal. x.*, 31.

Hab.—All warm climates.

Vernacular.—Lonia (*Hind., Beng.*), Kurfáh (*Pers.*), Bhuigholi (*Mar.*), Passelie Keeray (*Tam.*), Loni (*Guz.*).

History, Uses, &c.—The creeping annual Purslane has probably been long used as a domestic remedy by the Hindus. The Sanskrit names are Loniká and Lonámla. The fresh leaves are acid, and are prescribed when bruised as a cooling external application in erysipelas, and an infusion of them is given as a diuretic. In Arabic and Persian works the herb is

called Baklat-el-humaka or Baklat-el-mubarika and Kurfah; two kinds are described, the large and the small. The former is probably *P. oleracea*, as its use as a vegetable is noticed. Both kinds are said to be cold and moist, and to have detergent and astringent properties. Portulaca is the ανδραχνη of Dioscorides (ii., 113), and is mentioned by Celsus (2, 33), who calls it Portulaca. Macer says:—

> *Andrachne Græcis quæ portulaca Latinis*
> *Dicitur, hæc vulgi* pes pulli *more vocatur.*

(*Pulli pes, i.e.*, poulpied, whence the modern name pourpier.) The plant and seeds are recommended in a great many diseases of the kidneys, bladder, and lungs, which are supposed to be caused by hot or bilious humours. They are also praised as an external application in burns, scalds, and various forms of skin disease. Ainslie mentions *P. quadrifida* and *P. oleracea* as being used in Southern India by Tamil physicians. These herbs can be obtained in most vegetable markets, and the seeds of *P. oleracea* are kept in druggists' shops. In Guadaloupe, *P. pilosa, Linn.*, is known as pourpier amer or quinine-pays, on account of its bitter and febrifuge properties. It is best administered in the form of a tincture composed of Bitter purslane 100 parts, Rum 150 parts, Bordeaux wine 850 parts, Citrate of iron 5 parts. Dose 60—100 parts.

Description.—The two Portulacas, called Barra and Chota Lonia in Hindustani, may be readily recognised by their low growth, succulent, flat or nearly cylindrical leaves, and small yellow flowers (in *P. quadrifida* there are tufts of bristles in the axils), the seeds are black, minutely tubercled, and kidney-shaped; those of *P. oleracea* are much the largest. The leaves contain acid potassium oxalate and mucilage.

TAMARISCINEÆ.

TAMARIX GALLICA, *Linn.*

Fig.—*Wight. Ill.*, t. 24 *A.*; Var. ramosissima, *Ledeb. Ic. Fl. Ross.*, *t.* 256. Tamarisk (*Eng.*), Tamarisc de France (*Fr.*).

Hab.—Asia, Europe, Africa. The galls and manna.

Vernacular.—The galls, Barrí Main (*Hind.*), Samrat-ut-Turfah (*Arab.*), Magiya-main (*Bomb.*), Gazbar, Gazmázú (*Pers.*); the manna, Gazangabín and Gazanjabín (*Arab., Pers., Ind.*).

History, Uses, &c.—This small tree or bush is widely distributed in Europe, Africa, and Asia. Dioscorides, speaking of μυρίκη says that in Egypt and Syria it bears a seed like a gallnut, which is used as an astringent. (I., 101.) Pliny calls the same tree Tamarica (24, 41). It is the Tamarix of Columella (8, 15). Nicander calls the Tamarix μάντιν (prophetic). The Apollo of Lesbos is represented with a branch of the tree in his hand. The Persian Magi also prophesied with a branch in their hands. Herodotus and Pliny mention a similar use of the Tamarix. In Sanskrit it is called Jhávuka, and in Hindustani Jhau. The galls have probably long been used in Northern India as a substitute for the true gall. The manna is not produced in India, but in Persia and Arabia; in the month of June it drops from the tree, and is collected. In Persian works the galls of the Tamarix are called the fruit, and the manna is described as a dew which falls upon this and other trees, notably the willow and oak, and becomes solidified. The Hakíms consider the manna to be detergent, aperient, and expectorant. It is probably the δροσομέλι of Galen. In modern medicine manna is still used as a laxative; it slightly increases the action of the bowels, causing more frequent and softer stools without irritation. Its sweet taste makes it acceptable to children. The galls like those of the oak contain tannic and gallic acids, and may be used as an astringent in the same manner as true galls. (*See* Quercus.)

Description.—The galls are much smaller than true galls, 3-angled, and knotty; in the centre is a cavity which sometimes contains the fly, but generally only excrementitious matter. The manna occurs in small grains, which are nearly white when fresh, but in this climate have a tendency to liquefy and form a thick yellow fluid like honey; it is produced upon Tamarisk, willow and oak, in consequence of

the puncture of an insect. According to Ehrenberg, the insect which attacks the Tamarisk is the *Coccus manniparus*. The name Gazangabín signifies Tamarisk-honey, and is used, according to Haussknecht, at the present time in Persia to designate a manna collected in the mountain districts of Chahar-Mahal and Faraidan from two species of Astragalus (*confer. Pharmacographia*, p. 371). This account agrees with that found in Persian works on Materia Medica, which describe Gazangabín as the produce of several trees. Rich (*Residence in Koordistan*, Vol. I., p. 142,) describes the collection of Gazangubín, called by the Koords *Ghezo*, by picking the leaves of the trees, letting them dry, and then gently threshing them over a cloth. The season commences about the end of June. Aitchison states that in Khorasan it is produced by *Cotoneaster nummularia, Fisch. et Mey.**; the shrub is called Siyah-chub, and is very abundant upon the Siyah-Koh and Sufed-Koh hills and in the Ardewán Pass, forming thickets: the manna forms in July and is shaken into a cloth.

Chemical composition.—Tamarisk manna from Sinai, examined by Berthelot, was a thick yellow syrup, and was found to consist of cane sugar, inverted sugar (levulose and glucose) dextrin and water, the last constituting one-fifth of the whole. A specimen of Persian Gazangabín yielded to Ludwig, dextrin, uncrystallizable sugar and organic acids. The galls contain as much tannic acid as oak-galls and are readily purchased by manufacturers when offered for sale in Europe.

Commerce.—Gazangabín is imported into Bombay from Persia. Value Re. ½ per lb.; it is kept in most druggists' shops. The galls are sometimes abundant; at others unobtainable. Value, Rs. 12 to 13 per maund of 37½ lbs.

Tamarix articulata, *Vahl. Symb. ii.*, 48, *t.* 32. The galls.

* The leaves found in the Gazangabin imported into India are certainly those of Cotoneaster, as may be seen by a comparison with Aitchison's figure. (*Trans. Linn. Soc., 2nd Ser. Botany, Vol. III., Pt. I.*, 9.)

Vernacular.—Chotí Main (*Hind.*), Samrat-el-Asl (*Arab.*), Magiya-main (*Bomb.*), Gazbar and Azbah (*Pers.*). The tree is abundant in Sind and the Punjab, and is often cultivated. The galls are made use of as a substitute for true galls, a description of their properties and uses will be found in Arabic and Persian works under the name of Sumrat-el-Asl; these do not appear to differ in any important particular from the uses to which common galls are applied. These galls are smaller than those of *T. gallica*, and are not 3-angled; they are round, knotty, of the size of a pea, and of a yellowish brown colour. Small Tamarisk galls are occasionally offered in the market in large quantities, but are often not obtainable. Value, Rs. 12 to 13 per maund of 37½ lbs.

HYPERICINEÆ.

A number of species of Hypericum are found in the hilly parts of India, chiefly in the North, where *H. perforatum, Linn.*, is recognised by the Mahometans as representing the ὑπέρικον or ἀνδρόσαιμον of the Greeks. In Persia a plant, described by Mahometan writers on Materia Medica as a species of Hyufárikún (Hypericon) is known by the local names of Dádi and Jau-i-jádú or "magic barley." To these plants are ascribed the medicinal virtues which were formerly attributed to the St. John's worts of Europe; the old name of which was Fuga Dæmonum, in allusion to their supposed power of expelling the demon of hypochondriasis. Hypericum was also thought to act as a charm against witchcraft. On account of the red juice of the flowers, which was considered a signature of human blood, it was called ἀνδρόσαιμον by the Greeks, and was used as an application to wounds. The *Hypericum Androsæmum* of the botanists is the large bushy plant, so common in shrubberies in England, it is the Toute saine of the French, the Tutsan of the English, and the Rumman-el-anhar of the Arabs. By some it is considered to be the Hypericon of the Greeks. These herbs are bitter and astringent, and were formerly supposed to have detersive, resolutive, anthelmintic, diuretic and emmenagogue

properties when given internally. Externally they were used as vulneraries, and as excitants in chronic rheumatism. They are not used in modern medicine.

Chemical composition.—When the flowers of *H. perforatum*, freed from their calices and dried, are exhausted with absolute alcohol, and the tincture is evaporated, a soft residue is left of a red colour (hypericum red) together with volatile oil. If the flowers are exhausted with water, then with dilute alcohol, well dried after exhaustion, and the colouring matter extracted from them by ether, it remains on evaporation as a blood-red resin, having an odour of chamomile. It melts below 100° and does not yield ammonia by dry distillation. It is insoluble in water and in dilute acids. By aqueous ammonia, potash and soda, it is coloured green and dissolved; the saturated solution is red by reflected light, but exhibits after dilution a green colour by transmitted light. The ammoniacal solution leaves on evaporation a neutral blood-red resin having the odour of hypericum, soluble with yellow colour in water, and giving off ammonia when treated with potash. The red combines also with the alkaline earths, earths proper, and heavy metallic oxides; its alcoholic solution precipitates the alcoholic solution of chloride of calcium, also neutral acetate of lead and ferric chloride. It dissolves in alcohol, more readily in ether, with wine-red to blood-red colour, also in volatile oils and in warm fixed oils. (*Buchner.*) According to Marquart, the colouring matter of the fresh flowers is a mixture of anthocyan and anthoxanthin, separable by exhausting with alcohol and treating the residue with water.

GUTTIFERÆ.

GARCINIA INDICA, *Chois.*

Fig.—*Bent. and Trim., t.* 32; *Wight. Ill. I.*, 125. Red Mango (*Eng.*), Garcinia a fruit acide (*Fr.*).

Hab.—Western Peninsula, Amboyna. The fruit, seeds, and bark.

Vernacular.—The fruit, Ratámbi, Bhirand (*Mar.*), Brindaó (*Goa*); the oil, Kokam cha tel, Bhirandel (*Mar.*); the bark, Ratámbi sála (*Mar.*).

History, Uses, &c.—The tree is common on the Western coast between Damaun and Goa; it grows wild upon the hills of the Concan, but is often to be seen in gardens close to the sea. It flowers about Christmas, and ripens its fruit in April and May. The fruit is largely used all along the Western coast as an acid ingredient in curries, and is an article of commerce in the dry state. It is generally prepared by removing the seeds and drying the pulp in the sun: the latter is then slightly salted and is ready for the market. It is known as *Amsul* or *Kokam*, and was in use in the Bombay Army as an antiscorbutic in 1799. (*Dr. White.*)* In Goa the pulp is sometimes made into large globular or elongated masses. The seeds are pounded and boiled to extract the oil, which, on cooling, becomes gradually solid and is roughly moulded by hand into egg-shaped balls or concavo-convex cakes. This is the substance known to Europeans as *Kokam butter.* The natives occasionally use it for cooking, but it is mostly valued on account of its soothing properties when used medicinally. The juice of the fruit is sometimes used as a mordant in dyeing, and the apothecaries of Goa prepare a very fine red syrup from it, which is used in bilious affections. Nothing seems to be known of the history of the Kokam fruit before the time of Garcia d'Orta (1563), who found it in use at Goa, under the name of Brindão,† when he visited that city; the same name is still used by the native Christians. As it was an article of export in Garcia's time, there can be little doubt that it was used in Western India long before the Portuguese visited the country, just in the same manner as it is at the present day. The tree was known to Rumphius, who calls it Folium acidum majus or Groot Saur-

* MS. note signed by him in the Bombay Asiatic Society's copy of Rumphius.

† A corruption of the Marathi name भिरंड Bhirand.

blad. He says the young leaves are acid like sorrel, and are used in cooking fish in Amboyna. Kokam butter appears to have first attracted the notice of Europeans about 1830 as a remedy for excoriations and chaps of the skin; in order to apply it, a piece is partially melted and rubbed upon the affected part. It is also of great value for the preparation of Nitrate of Mercury ointment, which if made in the usual manner is too fluid for hot climates; Indian lard being very fluid, equal parts of it and Kokam oil will be found to make an ointment of good consistence and colour which keeps well. The bark is astringent, and the young leaves after having been tied up in a plantain leaf and stewed in hot ashes, are rubbed in cold milk and given as a remedy for dysentery.

Description.—The fruit is spherical, about the size of a small apple, red, containing an acid pulp of a still deeper colour, in which from 5 to 8 reniform seeds are embedded; the seeds are compressed laterally, wrinkled, about ¾ of an inch long by 4-10ths broad; the cotyledons are very thick, closely adherent, and have a sweet oily taste. Kokam butter is of a yellowish white colour, firm, dry and friable in the hottest weather, and greasy to the touch like spermaceti; its structure is crystalline; it generally contains impurities, and requires to be remelted and strained before it can be used for pharmaceutical purposes; the residue after this process consists chiefly of particles of the fruit and seed.

Microscopic structure.—The cotyledons are composed of large reticulated cells containing crystalline fat.

Chemical composition.—Flückiger and Hanbury give the following account of it:—"Purified Kokum butter, boiled with caustic soda, yields a fine hard soap, which, when decomposed with sulphuric acid, affords a crystalline cake of fatty acids weighing as much as the original fat. The acids were again combined with soda, and the soap having been decomposed, they were dissolved in alcohol of about 94 per cent. By slow cooling and evaporation, crystals were first formed, which, when perfectly dried, melted at 69·5° C.; they

are consequently Stearic acid. A less considerable amount of crystals which separated subsequently had a fusing point of 55° C., and may be referred to Myristic acid. A portion of the crude fat was heated with oxide of lead and water, and the plumbic compound dried and exhausted with ether, which after evaporation left a very small amount of liquid oil, which we refer to Oleic acid. Finally the sulphuric acid used at the outset of the experiments was saturated, and examined in the usual manner for volatile fatty acids (butyric, valerianic, &c.), but with negative results.

"The fat of the seeds of *G. indica* was extracted by ether and examined in 1857 by J. Bouis and d'Oliveira Pimentel. It was obtained to the extent of 30 per cent., was found to fuse at 40° C., and to consist chiefly of stearin (tristearin). The seeds yielded 1·72 of nitrogen. Their residue after exhaustion by ether afforded to alkaline solutions or alcohol a fine red colour." The dried fruit sold in the bazaar as kokam has been examined by Lyon (1881) with the following results:—Moisture, 37·04; hot water extractive, 42·90; cellulose, 5·52; insoluble residue, 14·54. Hot water solution bright red and very acid, turns bluish green on addition of alkalies in excess; acidity due to Malic acid. Tartaric acid either absent or traces only present. No Citric acid. Fixed free acidity = 13·537 per cent. Malic acid. Total ash 7·88. Insoluble in water 1·96; soluble in water 5·92. Chlorine of soluble ash as Na Cl = 4·62 per cent. Alkalinity of soluble ash as potash = 0·79 per cent. The Chloride of Sodium is probably introduced when the kokam is salted.

Commerce.—The dried fruit comes from Goa, Hingoli and Malwan. Value, Rs. 40 per candy of 28 Bombay maunds of 28 lbs. each.

Kokam butter comes from Goa. Value, Rs. 5 to 7 per Surat maund of 37½ lbs.

Garcinia Zanthochymus, *Hook. f., Roxb. Cor. Pl. II.*, 51, *t.* 196. A tree of Eastern Bengal, Eastern Himalaya,

Eastern Peninsula, Western Peninsula, produces a yellow fruit the size of a small apple and very acid, which is used for the same purposes as that of *G. indica*; it is dried and made into a kind of Amsúl. In bilious conditions a sherbet made with about 1 oz. of the amsúl with a little rocksalt, pepper, ginger, cummin and sugar, is administered. The nativo name is Onth. or Osht.

GARCINIA MANGOSTANA, *Linn.*

Fig.—*Bot. Cab.* 845. Mangosteen (*Eng.*), Mangostan (*Fr.*). The rind.

Vernacular.—Mangustan (*Ind.*).

Hab.—Malayan Peninsula, Southern Tenasserim.

History, Uses, &c.—The rind, or entire fruit dried, of the well-known mangosteen is brought to India from the Straits and Singapore, and is a popular remedy for diarrhœa and dysentery. Rumphius tells us that the Macassars also use the bark and young leaves for the same purpose and to cure aphthæ of the mouth. Dr. S. Arjun, of Bombay, has found the rind very useful in the chronic diarrhœa of children. It has also been used as a febrifuge. The medicinal action of this drug appears to be chiefly due to the tannin which it contains (*see* Quercus). The physiological effects of the crystallizable substance mangostin and of the resin have not been studied, but the drug may probably be classed with the terebinthinate astringents.

Description.—The fruit is globular, as large as a small apple, with a thick woody rind: it is crowned by the calycine segments, which form a kind of rosette: within it is a sweet acidulous white pulp and several seeds. The thick rind and the bark of the tree are very astringent, and yield an astringent extract which may be given in pills or syrup.

Chemical composition.—W. Schmidt has obtained a crystallizable substance, *Mangostin*, $C^{20} H^{22} O^{5}$, from the rind of the

fruit. To obtain it the rind is first boiled in water to remove tannin, and afterwards exhausted by boiling alcohol; upon evaporation of the alcoholic extract, a yellow amorphous mass is obtained, which consists of mangostin and resin; this is redissolved in boiling alcohol, and water added to the boiling solution as long as it causes a precipitate of resin. From the solution on cooling mangostin is obtained in small yellow scales; it may be purified by resolution in alcohol and precipitation by subacetate of lead; remaining traces of resin are removed by the addition of water to the alcoholic solution, and finally, after several recrystallizations from weak alcohol, the mangostin is obtained in thin golden yellow scales, which are tasteless, and fuse at about 190° C.; at a higher temperature it is decomposed, a portion subliming unchanged. Mangostin is insoluble in water, but readily soluble in alcohol and ether; its solutions are neutral, hot dilute acids dissolve it without change, hot concentrated nitric acid converts it into oxalic acid, sulphuric acid forms with it a deep red solution and chars it if heated. It forms yellow solutions with alkalies. It reduces solutions of the noble metals, and turns perchloride of iron of a dark green colour, which is removed by the addition of an acid. (*Ann. der Chem. und Pharm.*, t. xciii., p 83; *Wurtz, Dict. de Chim.*, t. ii., p. 310.)

GARCINIA MORELLA, *Desrouss.*

Fig.—*Bentl. and Trim., t.* 33; *Wight Ic., t.* 102. Gamboge tree (*Eng.*), Guttier des peintres (*Fr.*).

Hab.—Eastern Bengal, Western Peninsula, Eastern Peninsula, Ceylon. The gum-resin.

Vernacular.—The tree, Makki-maram, Korakapuli (*Tam.*), Jarigehulimara (*Can.*), Tamál (*Hind., Beng., Mar.*). The juice, Tamál (*Hind., Beng., Mar., Can.*) The drug Gamboge, Us-sáreh-i-Rewand, Gotaganba (*Pers., Ind.*), Revanchi-no-siro (*Guz.*).

History, Uses, &c.—The Gamboge tree of Malabar and Canara, which is also found in other parts of India, is by Beddome called *G. pictoria* and kept distinct from *G. Morella.* Hooker considers them both to be the same species. There would seem to be no doubt that Gamboge has never been collected in India as an article of commerce; and that it is only from a comparatively recent date that the drug has been known in this country; but the Hindus of Canara and Mysore, and probably of other parts of India, have for a long time used the juice of this tree under the Sanskrit name of Tamála as a pigment for making sectarial marks on the forehead, and this name is still current in Hindi, Bengali and Marathi. Other Sanskrit names for the tree are Tápiccha and Tápinja. The Ussárah-i-Rewand of Arabic and Persian books is, properly speaking, an extract of Rhubarb, as the name implies, but owing to a similarity in properties and also in colour, the same name was applied to Gamboge upon its becoming known as an article of commerce. Siam Gamboge is the only kind obtained in the drug markets. An interesting account of the history of commercial Gamboge will be found in the *Pharmacographia* from which it appears that it only became known to the Chinese about A.D. 1300, and was not introduced into Europe before 1603. Reudenius (1614—1625) described its medicinal properties and recommended its use as a purgative in arthritis (gout).

Description.—Through the kindness of Dr. Davies, when Civil Surgeon in Canara, we received a specimen of Gamboge collected there. It is in irregular fragments, and appears to have been collected upon leaves, portions of which still adhere to it. The finer pieces have the colour and consistence of Siam Gamboge, but contain many impurities, such as portions of wood and leaves. Fully half the sample is of a dirty yellowish brown colour, and has a spongy structure; this portion, treated with rectified spirit, gives a clear deep orange solution like ordinary Gamboge, but leaves a copious greenish yellow marc, which appears to be chlorophyll. As at present collected, this Gamboge is too impure for commercial purposes.

Chemical composition.—Indian Gamboge has been found by Christison (1846) to be essentially the same as that of Siam. It has also been examined by Broughton (1871), who is of opinion that it is equal to that of Siam. A sample of Gamboge from the Nagar district in Mysore was found by one of us to be remarkably pure; it had the following percentage composition :—Moisture, 5·4; resin, 80·4; gum, 13·0; dross, 1·2.

Commerce.—In the Indian markets the ordinary pipe Gamboge is alone met with. Price, Re. 1¼ per lb.

MESUA FERREA, *Linn.*

Fig.—*Rheede, Hort. Mal. iii.*, 53; *Wight Ill., t.* 127; *Ic. t.* 118. Iron wood tree (*Eng.*), Mésua Naghas (*Fr.*).

Hab.—E. Bengal, E. Himalaya, E. and W. Peninsulas, Andamans. The flowers.

Vernacular.—Nágkesar (*Hind., Beng.*), Nágchampa (*Mar.*), Nagecuram (*Tam.*), Naga-sampagi (*Can.*), Chikati manu (*Tel.*), Veila (*Mal.*)

History, Uses, &c.—This beautiful tree, with its large Cistus-like white flower, called in Sanskrit Kanjalkama and Nágkesara, is a favourite of the Indian poets. In the Naishada the poet compares the petals of the flowers from which the bees were scattering the pollen of its golden anthers, to an alabaster wheel on which Kamadeva was whetting his arrows, while the sparks of fire were dispersed in every direction. It is the *Castanea rosea indica* of Rheede, so called, because the fruits are like chestnuts in size and shape. The dried blossoms are prescribed by Hindu physicians as an adjunct to medicinal oils on account of their fragrance, and are also considered to have astringent and stomachic properties. Powdered and mixed with *ghí* (liquid butter) they are recommended by most of the later Hindu writers in bleeding piles, and burning of the feet. The root bark of *Mesua ferrea* contains

much resinous juice, which exudes freely when it is wounded; it has a reddish brown epidermis, consisting of ten or more rows of brick-shaped cells, full of condensed resin. Within the epidermis is a variable number of rows of cells of the same shape, yellow, refractive, and containing resinous juice; the medullary rays are also yellow and refractive; there are numerous large laticiferous vessels; the bark is mildly astringent and feebly aromatic, but is not bitter as stated in the Pharmacopœia of India. Rheede says that combined with ginger it is given as a sudorific. The oil of the seeds is used as an embrocation in rheumatism and as a healing application to sores. A poultice of the leaves made with milk and cocoanut oil is applied to the head in severe colds. (*Rheede.*) On the whole, the plant may be classed with the terebinthinate astringents.

Description.—The flowers are about 3 inches in diameter, sepals orbicular, thick, with membranous margins, inner pair largest; petals 4, spreading, cuneate-obovate, pure white; anthers large, oblong, golden yellow. Fruit ovoid, conical-pointed, size of a large chestnut; base surrounded by the persistent sepals, 1 to 4 seeded; seeds dark-brown, testa smooth; round the base of the young fruits a tenacious resin exudes, which in time covers them. The resin at first is soft, but hardens on exposure to the air; it is pleasantly aromatic.

Chemical composition.—The chief principle of *Mesua ferrea* appears to be an oleo-resin which abounds in all parts of the tree, and is obtained pure from the young fruits. The fresh tears sink in water, melt between 50° and 60° C., and partially dissolve in rectified spirit, amylic alcohol and ether, but wholly in benzol. Boiled with solutions of soda or ammonia the resin forms a clear mixture precipitable by acids in a white curdy condition. The solution in spirit has an acid reaction, and is dextro-rotatory when examined by polarised light; the solution gives a precipitate with alcoholic plumbic acetate, soluble when heated. From the partial solubility there are probably two resins present. Submitted to distillation 0·6

per cent. of a fragrant essential oil was obtained; this was of a pale yellow colour, and possessed in a high degree the odour of the flowers, and resembled that of the exudation of the Chio Turpentine.

The seeds yielded to ether 31·5 per cent. of fixed oil, the kernels alone gave 72·9 per cent. The oil thus obtained had a deep yellow colour, formed orange-coloured mixtures with sulphuric and nitric acid, was partially soluble in alcohol, and had a specific gravity of 0·972 at 17° C., a temperature at which it began to set, on account of the crystallization of the more solid fats. The hard pericarp contained a considerable amount of tannin.

Commerce—True Nágkesar is not an article of commerce in India. The oil of the seeds is sometimes offered for sale. Value, Rs. 4 per maund in Canara.

OCHROCARPUS LONGIFOLIUS, *Benth. and Hook.*

Fig.—*Wight. Ill. i.*, 130; *Ic. t.* 1999.

Hab.—Western Peninsula. The flower buds.

Vernacular.—Punnág, Támbra-nágkesar (*Mar.*), Ráti-nág-kesar (*Guz.*).

History, Uses, &c.—The dried buds of this tree are known in commerce as red Nágkesar. The tree grows in the forests of the Western Peninsula from Canara to the Concan, and is called Suringi by the Marathas and Punnága in Sanskrit; the buds are used chiefly for dyeing silk, but have also astringent and aromatic properties, and are sometimes prescribed medicinally. The fruit is eaten by children, who call it Gori-undi, or sweet Undi. The seed, which is as large as an acorn, exudes a viscid gummy fluid when cut. The medicinal properties of this plant are very similar to those of *Mesua ferrea*.

Description.—Flowers two-thirds of an inch in diameter, white, on nodes clothed with subulate bractioles in the axils of

fallen leaves; buds globose; pedicels 1 inch, slender; calyx bursting into 2 valves, reflexed during flowering; petals 4, thin, deciduous, white; stamens many; style subulate; stigma broad, discoid. The flowers are often hermaphrodite in cultivation. The dried buds are of a reddish brown colour and of the size of a small clove.

Commerce.—Nágkesar comes principally from Rajapur. Value, Rs 2-12 to 3 per maund of 28 lbs.

CALOPHYLLUM INOPHYLLUM, *Linn.*

Fig.—*Wight. Ill. i.*, 128; *Ic. t.* 77. Sweet-scented Calophyllum, Alexandrian Laurel (*Eng.*), Calophylle faux Tacamahac (*Fr.*).

Hab.—W. Peninsula, Ceylon, E. Peninsula, Andamans. The oil and seeds.

Vernacular.—Sultán Champa (*Hind.*), Undi (*Mar.*), Punnaigam (*Tam.*), Punnágamu, Ponna-chettu (*Tel.*), Suragonnemara (*Can.*). The oil, Sarpan-ka-tel (*Hind.*), Undi-che-tel (*Mar.*), Punnai-tailam, Punnai-kai, Pinna-cotai (*Tam.*), Laurel nut oil (*Eng.*).

History, Uses, &c.—This tree, wild, or in a cultivated state, is widely distributed throughout India, and is considered by some to be the Punnága or Késava of Sanskrit writers, but as its flowers are not collected, and those of Ochrocarpus are, and are still known as Punnága in Marathi, it seems probable that the latter plant is the true Punnága. The natives appear to regard both trees as varieties of one species. The Alexandrian laurel abounds in Travancore and on the Western coast. A greenish-coloured oil is expressed from the seeds, which is used for burning by the poorer classes, and is valued as an application for rheumatism, either alone or mixed with an equal portion of Hydnocarpus oil; it is also used as an application to exanthematous eruptions, and the seeds pounded with cashewnut seeds, borax and sparrow's dung are applied

as a *lep* to hasten maturation. At Pondicherry the oil has a reputation as a specific for scabies, and according to Corre and Lejanne, it has been tried unsuccessfully at the Saigon hospital as a cicatrizing agent. The Annamite name is *yao-monou.* The pounded bark is applied to swelled testicles. The tree when wounded exudes a small quantity of bright green resin, which is not collected, nor does it appear to be made use of in any way. This substance is soft and entirely soluble in rectified spirit; it has a parsley odour, and has been confounded with Tacamahaca, the exudation of *C. Calaba,* not a native of India. Rheede says that the resin is emetic and purgative; his expression is, 'the tears which distil from the tree and its fruit'; this is quite correct, as small tears of resin may often be seen adhering to the fruit.

Description.—The fruit is ovoid or round, and greenish-yellow when ripe; it varies in size; on old trees it is often as large as a bantam's egg; the pulp surrounding the nut dries up when the seed is mature, and the previously smooth skin covering it becomes brown or black and much wrinkled; the endocarp is hard, woody, and white, as thick as the shell of a filbert; within it is an inner endocarp, soft, and corky, of a red colour, thicker than the woody shell towards the apex of the fruit, but gradually becoming very thin towards the base, the inner surface of this layer is highly polished. The seed is of the same shape as the nut; it is very oily and has a rancid taste; it consists of two hemispherical cotyledons very closely united; under the microscope a stroma of small ovoid cells is seen, through which numerous large vessels loaded with green oil run in a longitudinal direction.

Chemical composition.—The resin melts easily and dissolves completely in alcohol; according to Sommer it does not yield umbelliferone by dry distillation. The oil of the almonds is greenish yellow, bitter and aromatic, sp. gr. 0·942; it solidifies at + 5°. (*Lepine.*) The fresh kernels examined by one of us gave off 30 per cent. of water in drying, and the dried kernels afforded 68 per cent. of oil. The oil was greenish-yellow, bitter,

and fragrant; sp. gr. 0·9315 at 16° C.; it commenced to congeal at 19° and set at 16°. The saponification equivalent was 285·6. The oil yielded 90·85 per cent. of fatty acids, sp. gr. 0·9237 at 16° and 0·8688 at 90°, melting at 37°·6, and possessing a combining weight of 283. If the oil be shaken up with a diluted solution of soda, and the red alkaline liquor be precipitated with an acid and then shaken up with ether, the ethereal extract leaves on evaporation a green crystalline residue having the odour of melilot and a bitter taste. The odorous crystalline body is also removed by agitating the oil with 85 per cent. alcohol. The oil is non-drying. Exposed for one month to the air at a temperature of 14°—20°, and for eight hours in a water-oven kept at the boiling point, the oil did not increase in weight. Treated according to Reichardt's distillation process, the oil yielded only a minute trace of volatile fatty acids. Three drops of sulphuric acid added to twenty drops of oil gave a red coloration with orange streaks; after stirring an orange-brown mixture was produced. With nitric acid a chocolate brown mixture was formed. A residue soluble in boiling water was obtained which had the peculiar odour of coumarin, but it did not yield any crystals of that substance. The oil must be classed with the cotton seed group of fixed oils.

Commerce—The oil under the name of Laurel nut oil is exported from Southern India. The exports from Travancore for the past five years had the following values:—1882-83, Rs. 74,314; 1883-84, Rs. 68,767; 1884-85, Rs. 48,997; 1885-86, Rs. 78,845; 1886—87, Rs. 57,148. The tariff valuation of the oil is Rs. 8 per cwt. as against Rs. 14 per cwt. for cocoanut-oil. The export from Alleppy in 1886-87 was 63 cwts. In Bombay it is not exported, but the country-people express it for burning, and use it medicinally. In Ceylon it is known as Domba oil. It is chiefly exported to Burmah, where it fetches a comparatively high price.

Calophyllum Wightianum, *Wall., Wight. Ill. i.,* 128; *Ic. t.* 106. Sira Punnai (*Tam. and Mal.*). This tree is abundant in Canara, where it is called Babbe, and extends to

Travancore. The gum occurs in large translucent irregular lumps of a yellowish colour; it is of horny texture, somewhat brittle, without odour; the taste is soapy. When placed in water it gradually softens, and finally disintegrates into a fine granular matter which floats in the form of flaky particles of a dirty white colour, and numerous oil globules which gradually collect upon the surface; the water dissolves a small portion and becomes slightly viscid.

Calophyllum tomentosum, *Wight, Beddome Fl. Syl. xxii., t.* 2; *Wight. Ic., t.* 110. Poon (*Eng.*). A tree of the Western Peninsula and Ceylon, in Marathi Punai, yields a gum which is black and opaque, and much mixed with pieces of corky bark; it has a feeble astringent taste, and is very soluble in cold water, to which it yields a yellow brown solution exhibiting a strong blue fluorescence. Alum followed by carbonate of soda throws down apparently some of the brown colouring matter without interfering with the fluorescence, as after precipitation the solution although lighter in colour is very strongly fluorescent.

A solution purified by alum in this way has its fluorescence immediately destroyed by acids and restored again by alkalies. Examining its absorption spectrum it is found that while fluorescent the solution gives a broad absorption band at the violet end of the spectrum extending to about G.; this band disappears on destroying the fluorescence by acids, but reappears on the addition of alkalies. The solution of the gum does not appear to rotate polarized light. The gum itself communicates only a very faint fluorescence to rectified spirit. (*Lyon.*)

TERNSTRŒMIACEÆ.

CAMELLIA THEIFERA, *Griff.*

Fig.—*Trans. Linn. Soc.* XXII., t. 61; *Bentl. and Trim.* 34. Tea plant (*Eng.*), Théièr (*Fr.*).

Hab.—Upper Assam, Cachar, China. Cultivated elsewhere.

Vernacular.—Cha, Chai. (*Ind.*)

History, Uses, &c.—There is reason to believe that the use of tea was unknown before the Christian era. This has been accounted for by the fact that the districts where the plant grows wild were not till then annexed to the Chinese Empire. Its origin, like that of many other useful plants, has formed the subject of an interesting myth, which attributes its discovery to the Buddhists in the latter half of the fifth century. According to a Japanese legend related by Kaempfer, the patriarch Bodhidharma, who died in China in the year 495 A.D., was so devoted an ascetic that he denied himself even natural rest. Being one day, however, overcome by sleep, he felt, on awaking, such keen remorse for yielding thus weakly to his lower nature, that he cut off both his eyelids and flung them on the ground. From these sprang the tea-plant. The holy man partook of its leaves, and found to his surprise that it endowed him with fresh vigour to renew his meditations. He communicated his discovery to his disciples, and taught them that method of using the leaves which thenceforward became generally practised. The first mention of tea in Chinese annals is in connection with a tax imposed on it in 793 A.D. The next reference to it occurs in the account of the travels of two Mahomedans in the ninth century. Europeans, however, do not appear to have acquired any knowledge of tea until the latter half of the sixteenth century, when it is noticed by Ramusio, Maffei, van Linschoten, and Botoro. Later on, it was again described by the Jesuit Trigault and by Olearius. It is generally supposed that it was first brought to Europe by the Dutch East India Company during the first half of the seventeenth century. The leaf reached Paris in 1635, and the shrub was planted there in the Royal Gardens in 1658. Russia first obtained tea in 1638, through Starkow, the envoy to the Mongol Altyn Khan, who entrusted him with two hundred packets of that commodity as a tribute for the Czar. Starkow is said to have considered it as worthless, and to have taken

charge of it very unwillingly. It found, however, great favour with the Court at Moscow, and soon became a national beverage. As regards the introduction of tea into England, the following are the most important facts to be considered. The first English vessels which ever sailed to the East and back belonged to the expedition under Lancaster, despatched by the London Company in 1601, soon after the grant of its original charter. None of these vessels returned home until after Elizabeth's death. If tea, therefore, reached England during her reign, it must have come from the East through a foreign channel. It has been supposed by some that tea was first brought over to England from Holland by Lords Arlington and Ossory in 1666. A treatise, however, by one Thomas Garnay, a retailer of tea, who wrote during the Commonwealth, proves that it was already in use amongst the English some years previously. He states that "in England it hath been sold in the leaf for six pounds, and sometimes for ten pounds the pound weight; and in respect of its former scarceness and dearness, it hath been only used as a regalia in high treatments and entertainments, and presents made thereof to princes and grandees till the year 1657." Later on in 1660, an Act of Parliament was passed, imposing a duty of eight pence on every gallon of tea made for sale. In the same year, also, Waller, the courtier-poet, wrote the following lines on the occasion of the marriage of Charles II. with Catherine of Braganza:

"The best of queens and best of herbs we owe
To that bold nation who the way did show
To the far region where the sun doth rise,
Whose rich productions we so justly prize."

From these facts we may conclude that tea was first introduced into England through the Portuguese before the year 1657. It is, however, highly improbable that it was long before that date, for until then it appears only as a very scarce and expensive luxury, and is not mentioned by a single earlier English writer. (*Tyrrell Leith.*)

There are two well-marked kinds of tea distinguished as black and green, of each of which we have several commercial varieties. Thus, of black teas, the best known sorts are Congou, Souchong, Oolong, Pekoe and Caper; and of green teas—Hyson, Hyson-skin, Young Hyson, Twankey, Imperial and Gunpowder. Many teas are scented with the flowers of the orange, rose, jasmine, sweet-scented olive, &c. The finest teas, some of which sell for as much as 50s. per lb., are consumed by the wealthier classes in China and Russia, and to a small extent in India. These teas are not manufactured in India. The various kinds of tea are all prepared from the same plant: thus, green tea consists of the leaves quickly dried after gathering, so that their colour and other characters are in a great measure preserved; and black tea consists of the leaves dried some time after being gathered, and after they have undergone a kind of fermentation, by which their original green colour is changed to black, and other important changes produced. It should be noticed, however, that much of the green tea is coloured artificially with a mixture of Prussian blue and gypsum, or indigo and gypsum, to which a little turmeric is sometimes added.

Both black and green teas are frequently adulterated with the leaves of other plants. The colour, odour and taste of both green and black teas are communicated to hot water, an infusion of the former having a more or less greenish-yellow colour, a peculiar aromatic odour, and an astringent feebly pungent and agreeably bitter taste; while an infusion of the latter has a dark brown colour, a somewhat similar but generally less agreeable odour, and an astringent, bitterish, but less pungent taste. The principal use of tea is to form an agreeable, slightly stimulating, soothing, and refreshing beverage. It was also formerly believed that tea, from the *theine* it contained, had the effect of diminishing the waste of the body, and as any substance that does this necessarily saves food, it was regarded as indirectly nutritive; but Dr Edward Smith has shown that, on the contrary, tea increases the bodily waste by acting as a respiratory excitant, and in other

ways. From containing gluten, tea has also been regarded as directly nutritive, but in the ordinary mode of making tea this substance is not extracted to any amount. The action of tea is thus described by Dr. Smith :—"It increases the assimilation of food both of the flesh and heat-forming kind; and with abundance of food must promote nutrition, whilst in the absence of sufficient food it increases the waste of the body." Tea is also a powerful astringent, and should not, therefore, be taken until some time after meals, as it is likely to produce dyspepsia from the combination of its tannic acid with the gelatine of the food and the production of an insoluble tannate; for the same reason if taken in excess it is likely to cause constipation. Tea should not be taken as a beverage by those who suffer from wakefulness, or by those who are liable to hysteria, or palpitation of the heart from valvular disease. As a nervine stimulant tea may be taken with advantage for headache and neuralgia, and in other affections caused by exhaustion of the system from depression of nerve power. Its effects as a nervine stimulant are due to the *theine* contained in it. (*Bentl. and Trim.*)

Pratt's experiments with *theine* seem to show that the motor nerves are not affected by it; he surrounded one crural nerve of a frog with a paste of theine and water, and irritated the spinal cord, when both legs responded with uniform alacrity. Pratt also found that when the left sciatic nerve of a beheaded frog was surrounded by a paste of theine and water, after ten minutes, irritation of the right foot produced reflex movements, whilst irritation of the left foot failed to elicit any response. T. J. Mays (*Polyclinic. Sept.*, 1887,) has shown that in theine we possess an agent which exerts no injurious action upon the organism, even when administered in large doses. To obtain this effect of theine he found subcutaneous injection sufficient, and in local neuralgias he injected as much as 15 centigrammes with excellent results. These injections were repeated daily for 21 days in obstinate cases with the effect of entirely subduing the pain; they caused no local irritation, nor did they interfere in any way with the patient's appetite or

prevent him sleeping. For subcutaneous injection theine should be combined with an equal portion of benzoate of sodium, which greatly increases its solubility. Pratt and others have shown that muscular fibre when brought in contact with theine, becomes strongly contracted, but it is uncertain whether this effect is produced by coagulation of the myosin or not. In muscles which had been soaked in curare until the nerves were killed the same rigidity was produced.

In comparing the physiological effects of theine and caffeine upon the excretions, it has been found by some experimenters that the former does not affect the elimination of carbonic acid, while the latter diminishes it, as well as the discharge of urea, uric acid, and water, in a larger proportion than theine. Caffeine also is said to increase the watery constituent of the urine, whilst theine diminishes it. However this may be, it is a matter of familiar observation that the effects of tea and coffee upon the system are by no means identical; for while coffee causes wakefulness as well as tea, in the former case it is rather a pleasing insomnia, not unlike that occasioned by small doses of opium, tranquil for the most part, and filled with pleasing reveries: while tea, on the other hand, induces in one who in vain endeavours to sleep after its use, a state of tension of the nervous system which is in the highest degree distressing. Upon almost every one coffee acts as a stimulant which is more or less cordial, flushing the face and rendering the pulse fuller, but such effects never follow the use of tea as direct consequences. It is seldom that a single indulgence in strong coffee induces that nervous agitation and tremulousness and impaired muscular power which are ordinary effects of strong tea; and unless we are greatly mistaken, gastralgia and other neuralgic affections are much more frequent among tea-drinkers than coffee-drinkers. It is very true that some of these apparent differences may be explained by the fact that tea is generally taken with only a small modicum of cream or milk, while coffee is as commonly used with a large proportion of one or both. Indeed, in France, where coffee is the universal breakfast drink, it is

always mixed with a great excess of milk, and is used pure chiefly after dinner, when the presence of food in the stomach retards its absorption and modifies its action. It is however customary for those who have mental or bodily work to perform before breakfast, to take a cup of "black coffee" immediately on leaving bed.

Theine and caffeine do not fully represent the sources from which they are respectively obtained. The identity of these alkaloids in their physiological action does not imply a similar identity in tea and coffee. As little should we be entitled to infer that all alcoholic drinks produce identical effects because they all contain alcohol as their chief constituent. It is just as certain that tea and coffee differ in their action upon the human system as that Rhenish or Bordeaux wine acts very differently from whisky or brandy, although in all of these liquors the common cause of their effects is alcohol. Moreover, not only are theine and caffeine physiologically identical, but so are guaranine, cocaine, and theobromine with them and with one another; and yet the operations of guarana, coca, and theobroma are different from one another, and from those of tea and coffee, in important particulars. It is unquestionably a fact of the highest possible interest that all of these vegetable products, which are used by different and remote nations, should contain identical proximate principles; but while we thus are led to admire the universality of physiological laws, we should not lose sight of the peculiarities which distinguish these important articles of human food from one another. (*Stillé and Maisch.*)

Chemical composition.—From some experiments made by us with fresh tea leaves, which had been dried by exposure to air, and which had not been subjected to any manufacturing operations, it would appear that gallic acid exists in the fresh leaf in only minute traces; but as the leaf during manufacture of tea is exposed to a high temperature, it is possible that the gallic acid in commercial tea may be present to a larger extent. Regarding quercetin, no distinctive needle-

shaped crystals could be obtained, though a principle similar to it is present.

In the last edition of Bloxam's Chemistry it is stated the aroma of tea does not belong to the fresh leaf, but is produced, like that of coffee, during the process of drying by heat, which develops a small quantity of a peculiar volatile oil having powerful stimulating properties. The freshly dried leaf is comparatively so rich in this oil, that it is not deemed advisable to use it until it has been kept for some time. We have found that freshly gathered leaf which has been dried simply by exposure to air possesses in a marked degree the aroma of manufactured tea. Our experiments would lead us to infer that the bouquet of tea is not solely dependent upon this volatile oil, which exists ready formed in the leaf, but is also due to the development by the action of heat, or some principle present in the leaf, of another odorous principle, and that the temperature necessary for the production of this secondary odorous principle need not exceed 100° Fahr.

Regarding the use of freshly manufactured tea, there appears to be an idea among some tea-planters that the use of the freshly manufactured article causes dysentery, but we are not in possession of the data on which the statement is founded.

A sample of tea bark contained 1·2 per cent. of theine, a much lower amount than is usually found in the leaves.

Manufactured tea contains a *volatile oil*, *gallotannic* and *gallic acids*, *quercetin*, and the so-called *boheic acid*, also the alkaloid *theine* said to be identical with caffeine obtained from coffee, and with the alkaloids of cocoa seeds, guarana, Paraguay tea, and kola nuts; more recently zanthine and another alkaloid, theophylline (dimethylzanthine) have been discovered in it. Theine and caffeine are trimethylzanthine. Zanthine is found in muscles, and along with creatine, assists muscular power; they are products of muscular waste. The occurrence of xanthine in tea was shown by Baginsoky in 1884 (*Zeits. f. Phys. Chem.* viii., 395.) and Kossel 1888 (*Ber. der. deutschen Chem. Ges.*

No. 11, p. 2164,) described a new base which he named *theophylline,* very similar in character to theobromine. It melts at 264° C., and sublimes at a temperature above its melting point. The crystals are larger than those of theobromine, but have the same chemical composition. Theophylline forms definitely crystallizable salts with hydrochloric and nitric acids, platinum chloride and gold chloride, as well as a crystallizable sparingly soluble double salt with mercuric chloride. Its formula is $C^7 H^8 N^4 O^2$.

Battershall (*Food Adulterations*) gives the following as the results of the analysis by American chemists of samples representing 2,414 packages of Indian teas :—

	Per cent.				Average per cent.
Moisture	5·83	to	6·325	—	5·938
Extract	37·80	,,	40·35	—	38·841
Total ash..................	5·05	,,	6·024	—	5·613
Ash soluble in water...	3·122	,,	4·280	—	3·516
Ash insoluble in water.	1·89	,,	2·255	—	2·092
Ash insoluble in acid...	·120	,,	·296	—	·177
Insoluble leaf............	47·12	,,	55·87	—	51·91
Tannin	13·04	,,	18·868	—	15·323
Theine....................	1·88	,,	3·240	—	2·736

Dr. B. H. Paul and A. J. Cownley (*Pharm. Journ., Nov. 19th,* 1887,) give the following interesting account of an inquiry undertaken for the purpose of ascertaining the circumstances that determine the differences of "strength" in tea:—

"One of the points to which we directed our attention was the extraction of the theine in such a way that precise analytical results could be obtained admitting of a comparison of different kinds of tea in regard to the percentage of theine. After several trials we found that the method we had previously adopted for coffee was capable of furnishing satisfactory results, and that with careful manipulation the amount of theine in tea could thus be determined with considerable accuracy.

For this purpose 5 grams of powdered tea is moistened with hot water, well mixed with one gram of hydrate of lime, and the whole dried on a water bath. The dry residue is then transferred to a small percolating apparatus and extracted with strong alcohol. The clear liquor is to be evaporated to remove alcohol, and the remaining water solution, measuring about 50 c. c., mixed with a few drops of dilute sulphuric acid, which separates a trace of lime and partially decolorizes the liquid. After filtering the slightly acid solution, it is transferred to a separator and well shaken with chloroform, which gradually abstracts the theine. This part of the operation requires particular care, for though theine is freely soluble in chloroform it is necessary to shake the acidified water solution with several successive quantities of chloroform in order to remove the whole of the theine. Unless the quantity of theine is very large, about 200 c. c. of chloroform will be sufficient for 5 grams of tea, and that should be used in 5 or 6 separate portions, testing the last portions by distilling off the chloroform in a weighed flask until it is found that there is no more theine taken up. The whole of the chloroform solution is then to be placed in a stoppered separator and shaken with a very dilute solution of caustic soda. This will remove a small quantity of colouring matter and render the theine solution quite colourless, so that on distilling off the choloroform from a weighed flask the theine remains in a condition fit for weighing. When the operation is carefully carried out, the theine will be perfectly white. In this way we have been able to obtain results of great uniformity.

Our first experiments were made with Indian and Cingalese tea, the general result showing that both kinds contained a much higher percentage of theine than has hitherto been generally supposed, and that the variation in the amount of this substance was not considerable. In this respect, however, there seems to be a marked difference between tea and coffee; the amount of theine in tea is by no means a constant quantity, and, so far as the tea of India and Ceylon is concerned, it varies from 3·22 to 4·66 per cent. This is taking the tea in

the ordinary air-dry condition in which it is met with in commerce. The following table gives the results of our determinations in twenty-eight samples that were selected for this purpose as representing a wide range of quality, as may be understood from the fact that the prices realised by the corresponding parcels in public sale varied from *7d.* to *3s.* per pound. The sample No. 10 was tea of exceptionally fine quality, that was valued at *6s.* or *7s.* per pound, and the sample No. 4 consisted of the hairs detached from the leaves in sifting :—

	Approximate elevation of place of growth.	Moisture per cent.	Theine per cent.	
			Original Tea.	Dry Tea.
Ceylon Tea.	Ft.			
1 Penhros	2,500	6·8	4·56	4·89
2 F. L. C.	……	6·0	4·56	4·85
3 Nahalma	300	5·6	4·54	4·80
4 Hairs from tea leaves	……	6·6	2·40	2·57
5 Hardenhuish Pekoe	3,500	3·8	4·08	4·24
6 Woodstock Pekoe Souchong	4,200	3·6	3·44	3·57
7 Radella Broken Pekoe	4,800	4·6	4·10	4·30
8 Morton Pekoe	400	4·2	3·98	4·15
9 Penhros Broken Pekoe	2,500	6·4	4·64	4·96
10 Strathellie Orange Pekoe	2,000	5·4	4·10	4·83
11 Nahalma Orange Pekoe	300	5·4	4·06	4·29
12 Venture Orange Pekoe	4,300	5·4	3·74	3·95
13 St. Leys Pekoe Dust	4,600	5·6	3·46	3·66
14 Venture Pekoe Souchong	4,300	4·8	3·40	3·57
15 Venture Broken Orange Pekoe	4,300	6·6	3·98	4·26
16 Calsay Pekoe Souchong	5,000	6·2	3·22	3·43
17 Venture Pekoe	4,300	5·6	3·48	3·68
18 St. Clair Orange Pekoe	4,200	4·6	3·90	4·09
Indian Tea.				
19 Pekoe tips, picked out	……	7·56	4·27	4·62
20 Broken Pekoe	……	7·00	4·48	4·81
21 Pekoe	……	6·40	4·16	4·44
22 Orange Pekoe	……	4·80	4·66	4·89
23 Pekoe	……	5·60	4·48	4·74
24 Broken Pekoe	……	4·80	3·76	3·95
25 Pekoe	……	5·40	3·66	3·86
26 "Weak" tea	……	6·80	4·06	4·35
27 "Strong" tea	……	5·80	4·18	4·43
28 Mixture	……	6·00	3·64	3·87

At present we have not had an opportunity of examining many samples of Chinese or Java tea that could be accepted as authentic, but so far as we have been able to judge the amount of theine is less than in the tea of India and Ceylon. But, so far as the tea of India and Ceylon is concerned, it is at least evident from the data above given, as compared with the prices mentioned, that the marketable value of tea is not to any great extent dependent on, or proportionate to, the amount of theine it may contain, however important that constituent may be in other respects. Neither can the "strength" of tea, as that term is generally understood, be taken as proportionate to the amount of theine. This is evident from the results of the analysis of the two samples, 26 and 27, which were selected by experienced judges of tea to represent extreme cases of difference as to strength. The amount of theine in 27 is greater than in 26, but to such a small extent that the difference in strength of the tea represented by those samples could not be ascribed to the theine they contain.

It appears to be much more probable that the "strength" of tea is chiefly determined by the amount or condition of the astringent constituent, the precise nature of which is at present only partially known. Moreover, when the mode of preparing tea is considered, it is also probable that this quality of "strength" may be largely influenced in degree by the manipulation of the leaves in the process of manufacture which comprises stages of fermentation and heating in the moist state in contact with atmospheric oxygen, both of which are conditions likely to induce alteration of material analogous to ordinary tannin. But before any definite opinion on this point can be offered in place of the general probability above suggested, it will be necessary to acquire a better knowledge of the chemical nature of that constituent of tea leaves which in some respects resembles ordinary tannin.

The commercial value of tea is at present estimated by a combined consideration of several factors, among which appear-

ance counts to a considerable degree. In this respect the size of the leaves, indicating their age and likewise the presence of what is termed "tip," consisting of the unexpanded leaf buds, serve as indications by which tea is classed partly as Souchong or Pekoe and partly also as varieties of those kinds of tea. In addition there is also the process of tasting practised by tea brokers. This consists in preparing infusions of the different samples much in the same manner that tea is commonly used, and then forming a judgment as to the value of the samples according to the aroma, flavour, and other characteristics of the corresponding infusions. This is an art that is practised with a surprising degree of precision, so that the results arrived at by different operators agree in a very remarkable manner. In carrying out the broker's test, tea is infused for five minutes in boiling water in the proportion of about 43 grains to 3½ fluid ounces of water. The infusion is then poured off from the leaves into a cup, and the value of the tea estimated by its taste. In this operation the soluble constituents of the leaves are only partially extracted, and while more perfect exhaustion of the leaves will give about 35 per cent. of extract, the amount taken out in the ordinary broker's method of testing does not amount to more than 20 per cent on the average. Hence it is evident that attempts to value tea on the basis of the total amount of extract obtainable by treatment with boiling water must be entirely fallacious and useless for any practical purpose. In respect to the amounts of extract thus obtainable from tea of different qualities, there is not in reality any such difference as would afford indications of the actual differences in value. Peligot and others have made determinations of this kind, showing that different kinds of black tea yield from 24 to 47 per cent. of extract, or on the average, 34 to 40 per cent., but these data have little practical value. It is indeed not by the perfect extraction of tea that its value can be estimated. This must be sought for within the limits of extraction which obtain in the ordinary methods of using tea, as is the case in the broker's method of testing, which fairly represents ordinary

practice in the use of tea, though the infusion is then made stronger than it is generally drunk.

To obtain some idea of the extent to which the constituents of tea are extracted under these ordinary conditions we have made analyses of the infusion thus prepared, and have ascertained as a general result that the 20 per cent. of extract taken out by the infusion will contain about one-half of the theine present in the tea used. An ordinary breakfast cup of equally-strong tea infusion measuring about eight ounces would therefore contain two grains of theine or thereabouts. The rest of the theine is left in the spent leaves, and it requires repeated treatment with boiling water to extract the whole quantity. This is no doubt one of the reasons why the amount of theine in tea has been under-estimated in so many instances, since experimenters have operated upon a water extract for its determination. In one instance we found that the residual leaves of tea which had been used in the customary manner contained as much as 1·7 per cent. of theine, and in another case leaves exhausted as far as practicable by percolating with boiling water still contained as much as 0·13 per cent. calculated on the original tea."

Commerce.—The great tea-producing country is China, where it is said four millions of acres of ground are devoted to its cultivation, and the produce annually is estimated at nearly three thousand millions of pounds. Tea is also largely produced in Japan, Java, Assam and Ceylon. (*Bentl. and Trim.*) Indian tea, which includes that of Assam, has now become an important article of commerce, but is objected to by many of the natives of India on account of its being more astrigent than China tea; it is chiefly exported to Europe through Calcutta. The exports during the last three years have been:—In 1885-6, 68·8 millions of pounds; in 1886-7, 78·7 millions; in 1887-8, 87·5 millions, valued at 517 lakhs of rupees.

The following figures show the percentage proportion of tea imported into Great Britain in 1886 and in 1887 from different

countries, and bear witness to the increasing favour with which Indian tea is regarded in England:—

	China.	British India.	Ceylon.	Java.	Other Countries.
1876, per cent. ...	84·03	14·99	0·05	0·78	0·15
1877, " " ...	53·17	31·15	5·89	0·32	2·47

—*Chemist and Druggist, April* 1889.

Gordonia obtusa, *Wall., Wight Ill. i.* 99, is a tall tree of the Western Peninsula from the Concan to Pulney hills, and is called Nagetta by the hill people. The leaves have been used in the Nilgiris as a substitute for tea; they resemble the tea leaf in size and shape, but may be distinguished by their obtuse points. The leaves contain a crystallizable and sublimable alkaloid like caffeine to the extent of 0·04 per cent., also tannic acid, and an odorous body very much like that contained in ordinary tea. The ash is lower: 3·96 to 3·67 per cent.

SCHIMA WALLICHII, *Chois.*

Fig.—*Griff. Notul.* iv., 562, t. 600.

Hab.—Eastern Himalaya, Nipal to Bhotan, Assam, Burma.

Vernacular—Chilauni, Makriyá-chilauni (*Hind.*). The Hindi names for this tree signify "that which causes itch," "that which causes monkey's itch." The part of the tree which has this effect is the bark, in which the liber-cells appear like glistening white needles which irritate the skin like cowhage, which drug it resembles in being a mechanical irritant. The bark is thick, externally smooth, of a greyish-brown colour and very irregular surface, caused by deep fissures and exfoliation of portions of the suber; internally it is of a reddish-brown colour and short fracture, and is remarkable for a number of white glistening liber-cells about $\frac{1}{18}$ of an inch long, which when magnified are seen to be translucent and sharp-pointed at both ends. The bulk of the parenchyma consists of cells containing much starch and a red colouring matter.

DIPTEROCARPEÆ.

DIPTEROCARPUS TURBINATUS, *Gärtn.f.*

Fig.—*Roxb. Cor. Pl.* iii., 10, *t.* 213.

Hab.—Eastern Bengal, Eastern Peninsula.

DIPTEROCARPUS INCANUS, *Roxb.*

Hab.—Chittagong, Pegu.

DIPTEROCARPUS ALATUS, *Roxb.*

Fig.—*Gärtn. f. Fruct.*, iii. 50, *t.* 187.

Hab.—Chittagong, Burma, Tenasserim, Andamans. Oil Tree. The oleo-resin, Garjan Balsam, Wood oil (*Eng.*).

Vernacular.—Garjan-ka-tel (*Hind., Bomb., &c.*), Yennai (*Tam.*).

History, Uses, &c.—Seventeen species of Dipterocarpus are noticed in Hooker's *Flora of British India* as growing in India and the Eastern Islands, but the three placed at the head of this article produce most of the Garjan Balsam of commerce. The Balsam does not appear to have been made much use of as a medicine by Hindus or Mahometans, for we have not found it noticed at any length in their standard works on Materia Medica. Under the name of Dubn-el-Garjan, a short notice of it will be found in the Makhzan. Ainslie mentions its use by the natives of Southern India in gonorrhœa. It was first brought prominently to the notice of Europeans by O'Shaughnessy in the Bengal Dispensatory as a substitute for Copaiba, but has never displaced that drug even in India, although favourable reports of its properties have from time to time appeared in the Medical journals. The natives of the East use it largely as a varnish, and for paying the seams of boats, as it is thought to preserve timber from the ravages of insects. Quite recently it has been brought prominently to

notice by Dr. Dougall, of the Andamans, as a remedy for leprosy. According to that gentleman, Garjan Balsam when administered internally and at the same time applied to the skin arrests the disease and promotes cicatrization of the ulcerating surfaces. In order to test the correctness of this statement, large quantities of the Balsam have been distributed by the Indian Government, but as far as we have heard the new treatment has not been a success. Dr. Dougall's directions for carrying out the treatment of leprosy by Garjan Balsam include frequent ablutions with dry earth and water, and strict attention to the hygienic condition of the patient; it seems probable that he has attributed effects to the Balsam which are in reality due to cleanliness and an improved hygienic condition. The method of extracting the Dipterocarpus Balsam was first described by Roxburgh; more recent accounts have been published, but they do not differ in any points of importance from his; shortly, one or more good-sized cavities are cut with an axe in the trunk of the tree about the end of the dry season, a fire is then lighted in them until the wood is scorched; arrangements are next made to catch the Balsam, which exudes very freely. The oil is extracted yearly from the same trees, and according to Roxburgh, a good tree will produce 30 to 40 gallons during the season; the surface of the cavity has to be occasionally cut away and re-burnt. Garjan Balsam has a stimulant action upon mucous membranes, especially that of the urinary tract, during its excretion by the kidneys. Like copaiba it forms a conjugate glycuronic acid in the system which appears in the urine, and with nitric acid gives a precipitate of gurjanic acid easily mistaken for albumen, but distinguished by its disappearing on the application of heat. The conjugate acid renders the urine antiseptic and prevents the development of bacteria.

Description.—The freshly-drawn Balsam is an opaque, grey fluid, which when placed in the sun gradually separates into two portions, the upper of which is a thick, viscid fluid of a dark reddish brown colour, and transparent when placed

between the eye of the observer and the light, but when viewed by reflected light it is opaque, greenish, and fluorescent. The lower stratum consists of a thick, dirty white magma, and is generally rejected, although it is said to have the same medicinal properties as the clear Balsam. The latter has a feeble copaiba odour, and a bitter aromatic taste; its specific gravity at 16·9° C. is ·964; it is soluble in pure benzol, cumol, chloroform, bisulphide of carbon, and essential oils, and partially so in methylic, ethylic, or amylic alcohol, in ether, acetic ether, glacial acetic acid, carbolic acid, or caustic potash dissolved in absolute alcohol; at about 130° C., it becomes gelatinous, and on cooling does not recover its fluidity.

Chemical composition.—The following account by Flückiger and Hanbury is taken from the *Pharmacographia* :—"Of the Balsam 6·99 grammes dissolved in benzol and kept in a water bath until the residue ceased to lose weight, yielded 3·80 grammes of a dry, transparent, semi-fluid resin, corresponding to 54·44 per cent., and 45·56 of volatile matters expelled by evaporation.

"By submitting larger quantities of the Balsam to the usual process of distillation with water in a large copper still, 37 per cent. of volatile oil were easily obtained. The water passing over at the same time did not redden litmus paper; a dark viscid, liquid resin remained in the still.

"The essential oil is of a pale straw colour, and less odorous than most other volatile oils; treated with chloride of calcium and again distilled it begins to boil at 210° C., and passes over at 260° C., acquiring a somewhat empyreumatic smell and light yellowish tint. The purified oil has a sp. gr. of 0·915 to 0·914, it is but sparingly soluble in absolute alcohol or glacial acetic acid, but mixes readily with amylic alcohol. According to Werner, this oil has the composition $C^{40} H^{32}$, like that of copaiba. He says it deviates the ray of polarised light to the left, but that prepared by one of us deviated strongly to the right, the residual resin dissolved in benzol being wholly inactive The oil does not form a crystalline compound with dry hydrochloric

acid which colours it of a beautiful blue. DeVrij states that the essential oil after this treatment deviates the ray to the right.

"The resin contains, like that of copaiba, a small proportion of a crystallizable acid, which may be removed by warming it with ammonia in weak alcohol. That part of the resin which is insoluble even in absolute alcohol, we found to be uncrystallizable. The gurjunic acid may consequently be prepared by extracting the resin with alcohol (·838) and mixing the solution with ammonia. From the ammoniacal solution gurjunic acid is precipitated on addition of a mineral acid, and if it is again dissolved in ether and alcohol it may be procured in the form of small crystalline crusts. Gurjunic acid, $C^{44} H^{68} O^{8}$, according to Werner, melts at 220° C, and concretes again at 180° C.; it begins to boil at 260° C., yet at the same time decomposition takes place. By assigning to this acid the formula $C^{44} H^{64} O^{5} + 3 H^{2}O$, which agrees well with Werner's analytical results, we may regard it as a hydrate of abietinic acid, the chemical behaviour of which is perfectly analogous. Gurjunic acid is soluble in alcohol 0·838, but not in weak alcohol; it is dissolved also by ether, benzol, or bisulphide of carbon.

"In copaiba from Maracaibo, Strauss discovered metacopaivic acid, which is probably identical with gurjunic; the former however fuses at 206° C. The amorphous resin forming the chief bulk of the residue of distillation of the balsam has not yet been submitted to exact analysis. We find that after complete dessication it is not soluble in absolute alcohol." Flückiger has since discovered (1878) in Garjan Balsam a crystallizable indifferent resin, formula $C^{28} H^{46} O^{2}$; it melts at 258·8° F. and dissolves in sulphuric acid with an orange colour.

Commerce.—Garjan Balsam is not an article of commerce in most parts of India, but small quantities may be sometimes obtained in the native drug shops. In Calcutta its price is from 3 to 5 rupees per maund of 80 lbs. Large quantities are exported from Moulmein to Europe. The Government supplies have been obtained from the Andaman Islands.

SHOREA ROBUSTA, *Gärtn. f.*

Fig.—*Beddome Fl. Sylv.*, *t.* 40. The Saul tree (*Eng.*).

Hab.—Tropical Himalaya, Central India, Western Bengal. The resin.

Vernacular.—The resin, Rál, Dhuna (*Hind.*, *Beng.*, *Mar.*), Kungiliyam (*Tam.*), Guggilamu (*Tel.*), Guggala (*Can.*).

History, Uses, &c.—The Sál tree, called in Sanskrit Sála and Asvakarna, is of interest from a mythological point of view, as the mother of Buddha is represented as holding a branch of the tree in her hand when Buddha was born, and it was under the shade of a Sála tree that Buddha passed the last night of his life on earth. The small branches of the Sála are used by Indian villagers to detect witches; they write the name of every woman over 12 years of age in the village upon a branch; the branches are then placed in water and left for 4½ hours; if any woman's branch withers, she is the witch.

This tree is very widely distributed throughout India, and is undoubtedly the source of the Rosin or Rál of Hindu and Mahometan writers on Materia Medica. Rál, in Sanskrit Rála and Sála-veshta, is regarded by the Hindus as attenuant, detergent, and astringent, and is sometimes prescribed internally mixed with sugar, honey or treacle; as resin does with us, it enters into the composition of stimulating plasters and ointments; it is also used for fumigating rooms occupied by the sick. The seeds of the Saul tree are eaten in times of scarcity with Mahwa flowers by the wild tribes of India. Mahometan writers give a similar account of its properties and uses. The author of the Makhzan-el-Adwiya (*vide* article Kaikahr) notices the fact that more than one kind of Rál is met with, but names the Sakoh or Sál as the source from which the genuine article is obtained. In another part of his work (*vide* article Sakoh) he describes the tree, and says that when old the bark becomes separated from the trunk by the deposit of Rál beneath it. Ainslie mentions three kinds of resin or dammar as common in the bazars of Southern India, but is in doubt as to the sources from

whence the different kinds are obtained. He observes that a great portion of the dammar used in India is imported from Java, Borneo, Joanna, and several of the Soloo Islands. The author of the Bengal Dispensatory, after conducting a series of experiments with genuine Sál resin, pronounced it to be an efficient substitute for pine resin. In Bombay, at the present time, American rosin is to a great extent displacing Indian Râl. Dr. Sakharam Arjun states (*Bomb. Drugs*) that he has seen Shorea resin mixed with sugar, given with good effect in dysentery. The oil of the seeds is extracted in Malabar. In the Wynaad *Shorea Talura, Roxb.* (*S. laccifera, Heyne,*) yields a fragrant resin, known as *Sambrani,* which is burnt as an incense.

Description —Rál varies in colour from dark brown to pale amber; it is devoid of taste and smell; sp. gr. 1·097 to 1·123, easily fusible, partially soluble in alcohol (83·1 per 1000), almost entirely in ether, perfectly in oil of turpentine and the fixed oils; sulphuric acid dissolves and gives it a red colour. By dissolving the resin in oil of turpentine and boiling it with a solution of potash until all the turpentine was expelled, O'Shaughnessy obtained a compound of resin and potash entirely soluble in water. The seeds have been examined by Church with the following result:—Water 10·8, albumenoids 8·0, starch 62·7, oil 14·8, fibre 1·4, ash 2·3 in 100 parts.

Commerce.—Rál is imported into India from Singapore in casks and bales. Value, Rs. 6 per cwt.

VATERIA INDICA, *Linn.*

Fig. —*Beddome Fl. Sylv., t.* 84; *Wight Ill. i.* 88, *t.* 36. Piney tallow tree (*Eng.*).

Hab.—Western Peninsula. The resin and fat.

Vernacular.—The tree, Dupada; the resin, Vellai-kungiliyam (*Tam.*)

History, Uses, &c.—The resin known as Vellai-kungiliyam has long been used by the natives of Southern India

as an incense, and for making varnishes. It is obtained by cutting notches in the tree, when it exudes and gradually hardens. Specimens differ much in colour, fragrance and density; some being of a light greenish colour, dense, homogeneous and vitreous on fracture, whilst others are amber-coloured, and vesicular. These differences apparently arise from the mode of collection; and the age of the trees producing them. It burns with a clear, steady light, giving off a pleasant smell, but very little smoke. With the aid of heat, and the addition of a small portion of camphor, it is soluble in spirit. Under the influence of gentle heat it combines with wax and oil, and forms an excellent resinous ointment. (*Dr. G. Bidie in Pharmacopœia of India.*) Vateria seeds yield a vegetable butter, known as the *Piney tallow* of Canara, or Malabar; this fat has a considerable reputation as a local application in chronic rheumatism, and might be used as a basis for ointments where increased consistency is required. It closely resembles the solid fats of *Garcinia* and *Bassia,* and like them consists chiefly of solid fatty acids. It would, no doubt, be valuable in the preparation of nitrate of mercury ointment. (*See article on Garcinia indica.*)

Chemical composition.—The seeds have been examined by M. M. Höhnel and Wolfbauer, who found that when air dried they afforded 49·2 per cent. of a greenish-yellow solid fat, which bleaches rapidly on exposure to light and has a peculiar agreeable balsamic odour. This fat rapidly saponifies, and consists of a mixture of fatty acids melting at 56°·6 and solidifying at 54°·8 C. The mixture contains oleïc acid, and 60 per cent. of a solid fatty acid melting at 63°·8. (*Chem. Centr.*; *Journ. de Pharm. et de Chim.*; *Journ. Chem. Soc.,* 1886.)

DRYOBALANOPS AROMATICA, *Gärtn.*

Fig.—*Hook. Journ. Bot.,* 1852, *t.* 7; *Hayne xii., t.* 17. Borneo Camphor (*Eng.*).

Hab.—Sumatra, Borneo.

Vernacular.—Bhimséni Kápúr or Káfúr *(Hind., Bomb.)*.

History, Uses, &c.—Sanskrit writers mention two kinds of camphor, *Pakva* und *Apakva* (cooked and uncooked); it is generally considered that Borneo camphor is meant by the latter term. In the Rájanirghantu oil of camphor is mentioned; this may refer to the Borneo camphor oil, or to some preparation made by dissolving camphor in oil. Mahometan writers describe the Borneo camphor as the best kind, and notice the way in which it is obtained by splitting the trunk of the tree. The author of the Makhzan-el-Adwiya gives a full account of it, and mentions the fact of several pieces of the timber having been brought to the Hughli, which when cut up into planks yielded a quantity of camphor. He also describes the way in which the oil is obtained by incising the tree. Borneo camphor is supposed by native physicians to have the properties of camphor in a much higher degree than ordinary camphor; on this account it fetches an extraordinarily high price. From the researches of Flückiger and Hanbury it appears that this camphor was the only kind known in Europe in the Middle Ages and was the καφουρά of the later Greek writers, who obtained their knowledge of it from the Arabians. Camphor is considered by the Hindus to be hot and dry, and by the Mahometans to be cold and dry, and to stimulate the brain and heart; it is prescribed in a great variety of disorders. The Hindus consider Borneo camphor to be aphrodisiacal, but the Mahometans hold a contrary opinion; both regard it as a valuable cooling application to the eyelids in inflammatory conditions of the eye. Ainslie mentions the Dryobalanops camphor as having been recently described by Mr. H. T. Colebroke, who was the first to determine its Botanical source, but wrongly supposes it to be the chief source of the camphor used in India. Mr. John Macdonald (1793) described the collection of the camphor in Sumatra in the following terms:—"The Sumatrians previous to their setting out in search of camphor discharge a variety of religious duties and ceremonies. They select old trees and pierce them, if they yield oil plentifully it

is presumed they contain concreted camphor, which is found in small whitish flakes, situated perpendicularly in irregular veins, in and near the centres of the trees. The tree is cut down, divided into junks and carefully divested of its camphor. The camphor is repeatedly washed and soaked in soapy water to clean it. When clean it will sink in water, and have a white glossy smooth appearance, tending to transparency After washing it is passed through three sieves of different mesh, so as to be divided into head, belly, and foot camphor: certain proportions of each compose the chests made up for the China market, where they are sold for £350 sterling nearly. An inferior kind is made by boiling down the liquid oil. Sumatra affords annually from 15 to 20 piculs of 133⅓ lbs. each, and more oil than there is at present a demand for." (*As. Researches, iv.*, 19.) Flückiger and Hanbury in the *Pharmacographia* say:—"The produce of a single tree does not, it is supposed, often exceed 11 lbs. A good proportion of the small quantity produced is consumed in the funeral rites of the Batta princes. The camphor which is exported is eagerly bought for the China market, but some is also sent to Japan, Laos, Cochin China, Cambodia and Siam." In India it is chiefly used by the Jains to prepare an *Abir* or sacrificial powder called *Vasakshepa*; this powder consists of sandalwood, saffron, Borneo camphor and musk

Dr. Stockman has proved that Borneo camphor has exactly the same physiological action as laurel camphor. He points out that laurel camphor, borneol and menthol form a group of substances very closely allied to each other in physiological action, borneol resembling very nearly monobromide of camphor in this respect. All are closely related to the alcohol group in their physiological effects, menthol approaching the latter most nearly; but as the number of hydrogen atoms diminishes there is an increased tendency to convulsions of cerebral origin. Borneol and menthol however differ from pure ethylic alcohol in powerfully dilating the peripheral vessels. Borneol is also a less irritating substance locally

than laurel camphor, and can be given in much larger doses than the latter without causing untoward cerebral symptoms.

Description and chemical composition.—Borneo camphor, also termed by chemists Borneol or Camphyl alcohol, is somewhat harder than common camphor, also a little heavier, so that it sinks in water. It is less volatile, and does not crystallize on the interior of the bottle in which it is kept; and it requires for fusion a higher temperature (198° C.). It has a somewhat different odour, resembling that of common camphor, with the addition of patchouli or ambergris. The composition of Borneol is represented by the formula $C^{10} H^{18} O$. It may be converted by the action of nitric acid into common camphor, conversely, as Berthelot has shown, Borneol may be prepared from common camphor by heating the latter with alcoholic potash. The artificial Borneol has the same composition as the natural article, but differs in optical power, and has therefore been termed Camphol. (*Pharmacographia.*) An alcoholic solution of Borneol examined by Dr. Lyon of Bombay proved to be 12½° dextrogyre. Besides camphor, the Dryobalanops furnish a liquid termed camphor oil, which must not be confounded with the camphor oil that drains out of crude laurel camphor. This Bornean or Sumatran Camphor oil is called Borneene, and is isomeric with oil of turpentine, $C^{10} H^{16}$, yet in the crude state, holding in solution Borneol and resin. By fractional distillation it may be separated into two portions, the one more volatile than the other, but not differing in composition. (*Pharmacographia.*)

According to Dr. Beckman laurel camphor may be converted into Borneo camphor in the following manner:—The camphor is dissolved in ether or some other solvent indifferent to the action of sodium, and repeatedly treated with sodium and then with water. The reaction is shown by the equation—

$$2\ C^{10} H^{16} O + Na = C^{10} H^{15} Na\ O + C^{10} H^{17} Na\ O.$$

These sodium compounds are decomposed by water with the formation of molecular quantities of camphor and borneol:

$C^{10} H^{15} Na O + C^{10} H^{17} Na O + 2 H^2 O = C^{10} H^{16} O + C^{10} H^{18} O + 2 Na O H.$

The solution of camphor and borneol so obtained is treated afresh with sodium and water until all the camphor is converted into borneol.

Commerce.—The quantity annually shipped from Borneo was reckoned by Motley in 1851 to be about 933 lbs., the export from Sumatra was estimated by De Vriese at 10—15 quintals per annum. The quantity imported into Canton in 1872 was returned as 3,159 lbs., value 42,326 taels, equivalent to about 80*s.* per lb. In the Annual Statement of the Trade of Bombay for the year 1872-73, 2 cwts. of Malayan camphor is stated to have been imported; it was valued at Rs. 9,141. The price in Borneo in 1851 of camphor of fine quality was 30 dollars per catty, or about 95*s.* per lb. (*Pharmacographia.*) At the present time, good Borneo camphor is worth in India Rs. 100 per lb.; an inferior quality is sold at from Rs. 70—80 per lb. An alcoholic solution of the latter examined by Dr. Lyon was about 2½° lævogyre; on this account he thinks it must be a mixture of Borneo and Ngai camphor, the product of *Blumea balsamifera* (For a description of which, see *Pharmacographia.*)

MALVACEÆ.

ALTHÆA OFFICINALIS, *Linn.*

Fig.—*Bentl. and Trim., t.* 35. Marsh Mallow (*Eng.*), Guimauve (*Fr.*).

Hab.—Temperate climates. The flowers, carpels, leaves and root.

Vernacular.—The flowers, Gul Khairu (*Pers., Ind.*); the carpels, Tukm-i-Khitmi (*Pers., Ind.*); the root, Rishah-i-Khitmi (*Pers., Ind.*).

History, Uses, &c.—A plant called Althæa is mentioned by Dioscorides,* and was held in great esteem by the Greeks and Latins † on account of its healing properties. Theophrastus says of Althæa, *καί ἣν οἱ μεν ἀλθαίαν, 'εκεῖνοι δε μαλάχην ἀγρίαν καλουσι.* Some consider the althæa of Theophrastus to have been *Lavatera arborea* (the tree mallow), but as it is described as having yellow flowers (*ix.*, 19,) this cannot be correct. Perhaps *Abutilon Avicennæ, Gärtn.*, was the plant. The Mahometans describe *Khairu* as a suppurative and emollient; they use the leaves as a poultice and for fomentations; mixed with oil the leaves and flowers are applied to burns and parts bitten by venomous reptiles. The root boiled with sugar is prescribed in coughs and irritable conditions of the intestines and bladder. The decoction is also used as an emollient enema, and in making ointments; in short, with the Mahometans it is as important an article of the Materia Medica as with the French and other Continental nations in Europe. Althæa is demulcent and emollient; its action is mechanical, inasmuch as it forms a soft smooth covering to the inflamed or irritated parts with which it comes in contact and thus protects them from friction, and allows the process of repair to go on undisturbed.

Description.—The different parts of the plant used in India are imported from Persia. The flowers have by some been attributed to *A. rosea*, but the carpels which may be found mixed with them, have not the membranaceous margin of that plant, and the exterior calyx has from 8 to 9 divisions instead of 6. The calyx is thick, and covered with simple hairs, very closely set, and arranged in star-like tufts; the flower has five petals, which in the dry article are bluish green at the base, the blades being purple; both calyx and flowers are mucilaginous. The root appears to be the same as the European article, but it is not decorticated, nor is it so plump and free from fibre. The carpels are large and pubescent, and are known as Tukm-i-khitmí.

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* Dios. iii., 154.

† Pliny 20, 84.

Microscopic structure.—The cortex of the root is chiefly liber; the parenchyme consists partly of starch and partly of mucilage cells; stellate raphides may be seen. The central portion is composed of wood cells, scalariform and pitted vessels, and parenchymatous tissue.

Chemical composition.—According to Flückiger and Hanbury, the mucilage in the dry root amounts to about 25 per cent. and the starch to as much more. The former appears to agree with the formula $C^{12} H^{20} O^{10}$, thus differing from the mucilage of Gum Arabic by one molecule less of water. It likewise differs in being precipitable by neutral acetate of lead; at the same time it does not show the behaviour of cellulose, as it does not turn blue by iodine when moistened with sulphuric acid, and it is not soluble in ammoniacal solution of oxide of copper. The root also contains pectin and sugar, and a trace of fatty oil. Tannin is found in very small quantity in the outer bark alone. Marshmallow root contains from 0·8 to 2·0 per cent. of asparagin, which is a widely diffused constituent of plants; it crystallizes in large prisms or octohedra of the rhombic system, and is tasteless and apparently destitute of physiological action. The peeled root dried at 100° C. and incinerated affords 4·88 of ash, rich in phosphates. (*Pharmacographia.*)

Commerce.—The flowers, carpels and root are imported from Persia. Value, flowers, 2 annas per lb.; seeds, 4 annas; root, 4 annas.

In connection with this drug may be mentioned the Althéa of the Portuguese at Goa, a substitute for Althæa; it is the root of *Grewia scabrophylla, Roxb.* The drug consists of the young roots, the largest being about as thick as the little finger. They are straight, unbranched, and have a thin brown cortex covering a thick white parenchyma, in which are seen well marked yellowish medullary rays, spreading from a tough, woody, central column, the diameter of which is less than the semi-diameter of the white portion; examined under the microscope most of the cells of the parenchyme are seen to be

filled with starch granules; but some large ones contain mucilage only. The central woody column abounds in large pitted vessels. Soaked in water the root gives out abundance of mucilage having a faintly bitter taste. When properly scraped and dried it is very white and apparently an efficient substitute for the imported article.

The roots of *Hibiscus Rosa sinensis*, Shoe-flower (*Eng.*), Ketmie de Cochin-Chine (*Fr.*), the Jásund or Jásus of Bombay, the Java of Hindustan, Shappathupu of Madras, Foulsapattes of the French Creoles, and Java or Japa of Sanskrit writers, are also dried and sold in the shops as a substitute for Althæa. In the Concan the fresh root-juice of the white flowered variety is given in doses of two tolás with milk, sugar and cummin for gonorrhœa, and the root powdered is given with an equal quantity of Lotus-root and the bark of *Eriodendron anfractuosum* in the same manner for menorrhagia, the dose of the three being 6 massas. This shrub is the Flos festalis of Rumphius (vi., II.), who relates the confession of a native of Banda in 1655 that he had caused the abortion of his concubine by giving her the flowers rubbed down with Papaya seeds. He says they are popularly considered to be emmenagogue in Amboyna. In India the Papaya is considered an abortifacient, but not the flowers of *H. Rosa sinensis*; the notion is evidently a fanciful one, and connected with their red colour.

MALVA SYLVESTRIS, *Linn.*

Fig.—*Eng. Bot.* 671. Common Mallow (*Eng.*), Mauve sauvage (*Fr.*).

Hab.—Temperate climates. The fruit.

Vernacular.—Khubázi (*Arab.*, *Ind.*).

History, Uses, &c.—This plant, or *M. rotundifolia*, is generally supposed to have been the μαλαχη of Dioscorides,*

* Dios., ii., 109, who says that Zoroaster called it Diadesma and the Egyptians Khokorteen. Prosper Alpinus describes and figures *Corchorus olitorius* as Melochia. Theophrastus, H. P. I., 4, describes Malache as a shrub; his plant may have been *Lavatera arborea*.

which was used by both Greeks and Romans as a medicine on account of its mucilaginous and cooling properties. It is the Nán-i-kulagh, "crow's-bread," and Khitmi-i-kuchak, "small Khitmi" of the Persians. Mauláná Nafis describes three kinds of malokhia, *viz.*:—

1st, A cultivated kind called Malokhia.

2nd, A large wild kind called Khitmi.

3rd, A small wild kind called Khubázi.

The author of the Makhzan-el-Adwiya pronounces the last mentioned to be the article known as Khubázi, and describes it thus:—"Leaves roundish, tasteless, a little hairy on the under surface; flower small, reddish purple; fruit round and flat, depressed in the centre, colour white or brown. The plant is much smaller than Khitmi." All parts of this plant are commended in Mahometan works on account of their mucilaginous and cooling properties, but the fruit is considered to be most efficient. Pliny, quoting Xenocrates, says that the seeds are aphrodisiacal, and such would appear to be the opinion of the Mahometans of India. In modern medicine the common mallow is considered to have properties similar to Althæa.

Description.—The fruit consists of from 10—12 glabrous wrinkled carpels, each containing one reniform seed; some of it is mature, but at least half is in various stages of immaturity, a portion of the thin papery calyx is attached to the fruit, and in a good fresh sample a few deep blue flowers may be found as well as the peduncles and portions of the leaf. Some seed planted in Bombay in June grew freely, and produced strong flowering plants in the rainy season.

Chemical composition.—Water dissolves the mucilage and a little bitter extractive.

Commerce.—The fruit is imported from Persia under the name of Khubázi. It is worth Re. ¼ per lb.

SIDA CARPINIFOLIA, *Linn.*

Fig.—*Wight Ic., t.* 95; *Hort. Mal. x.,* 53.

SIDA RHOMBIFOLIA, *Linn.*

Fig.—*Cav. Diss. I., t.* 3, *f.* 12.

SIDA CORDIFOLIA, *Linn.*

Fig.—*Dil. El.* 171, *f.* 209.

SIDA SPINOSA, *Linn.*

Fig.—*Cav. Diss. I., t.* 1, *f.* 9.

Hab.—The tropics generally. The roots.

Vernacular.—*S. carpinifolia, rhombifolia* and *cordifolia*, Bariára (*Hind.*), Bala, Janglí-methí (*Guz.*), Tupkaria, Tukati, Chikana, Páta (*Mar.*), Malai-tangí, Mayir-manikham (*Tam.*), Chitimuttí, Mayir-manikkam (*Tel.*), Svet-berela, Koreta, Bon-methi (*Beng.*) *S. spinosa,* Gulsakari (*Hind.*).

History, Uses, &c.—The plants belonging to this genus are known in Sanskrit by the general name Bala. Five kinds of Bala are mentioned by Sanskrit medical writers under the name of *Pancha-bala,* viz., Bala, Nágabala, Mahabala, Atibala and Rajabala. The Hindus regard the roots of the different species of Sida as cooling, astringent and tonic; they prescribe them in nervous and urinary diseases, and in fever. The root bark is beaten up with milk and sugar, and aromatics and stimulants are sometimes added. (*For original prescriptions, see Dutt's "Hindu Materia Medica,"* p. 121.) In the Concan the leaves of *S. cordifolia* (Chikana) with other cooling leaves are applied in ophthalmia; the root-juice is used to promote the healing of wounds, and the juice of the whole plant pounded with a little water is given in ¼ seer doses for gonorrhœa. The root of *S. carpinifolia* (Tupkaria) is applied with sparrow's dung to burst boils. The Mahometans consider Bala to be aphrodisiac. Ainslie notices several species of Sida,

and the uses to which they are applied by the Hindus. The author of the Bengal Dispensatory, after a trial of the roots of *Sida carpinifolia*, was unable to satisfy himself as to its febrifuge action, but it was found to promote perspiration, to increase the appetite, and to act as a useful bitter tonic. In Goa the Portuguese value it as a diuretic, especially in rheumatic affections; they also use it as a demulcent in gonorrhœa. In Pudukota the plant of *S. humilis, Willd.*, is ground with onions and administered for gonorrhœa. Its Tamil name is Pelambaci. *S. rhombifolia* is called in Australia "Queensland Hemp," and in N.-S. Wales "Lucerne," as cows are very fond of it. It is also called "Jelly-leaf" on account of its mucilaginous nature. In the various species of Sida we have demulcent and emollient properties combined with bitterness.

Description.—The roots of the different species of Sida are about ¼ of an inch in diameter at the stock, woody, and fibrous. The bark is of a light yellowish brown colour; unless the leaves are attached they cannot be distinguished with any certainty. In Western India, *S. carpinifolia* and *S. cordifolia* are most used. The first has smooth lanceolate, serrated leaves; the second cordate, tomentose leaves.

Chemical composition.—The root of *S. carpinifolia* strikes a blue colour with salts of iron, does not precipitate gelatine, yields to boiling water 23 and to alcohol 19 per cent.; it contains asparagin.

Commerce.—None of the roots are articles of commerce.

ABUTILON INDICUM, *G. Don.*

Fig.—*Wight Ic., t.* 12. Country Mallow (*Eng.*).

Hab.—Tropical India, Ceylon. The bark, leaves, and seeds.

Vernacular.—Kanghí (*Hind.*), Petári, Madmi, var *tomentosum*, Chakra-bhenda (*Mar.*), Tubocuty (*Goa.*), Tutti (*Tam.*) Kapáta, Dábali (*Guz.*). The seeds, Balbij (*Hind., Bomb.*)

History, Uses, &c.—There are several varieties of this plant, the most remarkable being a tomentose, hoary variety, which produces the Balbij of the shops, and another with purple stems called Kali kanghi in Hindustani and Koran-tutti in Tamil. The leaves, bark and seeds would seem to have been long in use among the Hindus on account of their mucilaginous and diuretic properties. Under the names of Masht-el-ghoul and Deishâr, short notices of the plant may be found in Arabic and Persian books. Ainslie's *Sida Mauritiana* is evidently identical with it. The bark is valued as a diuretic, and the seeds on account of their demulcent and mucilaginous properties. *A. indicum* is very common on waste ground, and appears to flourish in poor soil, and requires but little water. Ibn Sína mentions a drug called Abútílún ابوطيلون which was applied to wounds, but as he likens it to a Pumpkin it must have been quite different from the plants now known as Abutilon, unless his meaning is that the fruit resembles a miniature pumpkin in shape; in which case *Abutilon Avicennæ, Gärtn.*, may have been the plant.

Description.—The bark occurs in long, thin, tough, fibrous strips, which are very strong; externally it is striated and covered by a cinnamon-coloured epidermis, internally it is white and striated; the striæ are produced by small interspaces between the fibrous bundles of which the bark is chiefly composed. The taste is feebly astringent and bitter. The seeds of the tomentose variety are reniform, about 1-10th of an inch long, and nearly as broad at the larger end, three in each carpel; testa very hard, dull brown, covered with simple hairs, rising from a conical base, which is attached to the testa by radiating processes like roots. The following is a description of the plant obtained by sowing the Balbij of the shops:—Shrubby, hoary, covered all over with a dense silky tomentum of simple hairs; leaves cordate, unequally and sharply serrated; calyx 5 cleft; pedicels axillary, jointed near the flowers, which are of an orange colour, and open in the evening; capsules truncated, longer than the calyx; carpels about twenty, not awned, hairy on the dorsum. (*A. muticum, G. Don.*)

Chemical composition.—The leaves contain a large quantity of mucilage precipitable with neutral plumbic acetate and ferric chloride, a little tannin or organic acid not affected by gelatine solution, and traces of asparagin. During the ignition of the dried leaves ammonia is evolved in some quantity, and when completely burnt, over 16 per cent. of white mineral residue is left. Nearly half the ash consists of alkaline sulphates and chlorides, and the remainder of magnesium phosphate, calcium carbonate and sand.

Commerce.—The seed is sold by all druggists. Value, Rs. 6 per Surat maund of 37½ lbs.

HIBISCUS ABELMOSCHUS, *Linn.*

Fig.—*Wight Ic., t.* 399. Musk Mallow (*Eng.*), Ketmia Ambrette (*Fr.*).

Hab.—Most tropical countries. The seeds.

Vernacular.—The seeds, Mishk-dánah, Mishk-bhendi-ke-bij (*Hind.*), Kasturi-benda-vittulu (*Tel.*), Káttuk-kasturi (*Tam.*), Kasturi-dána (*Beng.*), Kasturi-bhenda-che-bij (*Mar.*).

History, Uses, &c.—These aromatic seeds are regarded by the Hindus as cooling, tonic and carminative. Arabic and Persian writers notice them under the name of Mishk-dánah, and describe them as Indian, and especially abundant in Bengal; they consider them to be cold and dry, and to have stomachic and tonic properties. The author of the Makhzan-el-Adwiya recommends a mucilage prepared from the root and leaves of the plant in gonorrhœa. The seeds are noticed by Ainslie, who states that in Arabia they are mixed with coffee. He suggests their use as a perfume. Abelmoschus is a corruption of the Arabic name, Hab-el-mishk. The seeds (grains d' ambrette) are largely imported into France from the West Indies by perfumers, who use them as a substitute for musk.

Description.—The seeds are brown, about 2 lines long, kidney-shaped, slightly compressed, marked with minute parallel elevated lines; they have a small distinct hilum; the odour is purely musky.

Chemical composition.—M. Bonastre, who analysed the seeds, found them to consist of parenchyme and moisture 52, gum 36, alumen 5·6, and fixed oil, solid crystalline matter, odorous principle and resin 6·4 per cent. The fixed oil was greenish yellow, fluid at 32° Fahr., but solidified gradually by exposure to the air. The solid crystalline matter was deposited from the hot alcoholic solution of the seeds; it was white, pearly, of a pleasant taste, soluble in ether, from which it crystallized in rays, fusible at 95° Fahr. The odorous mattter was a light green fluid with a strong smell of musk; it was not volatile.—(*Journal de Pharmacie*, Vol. xx., p. 381.) Messrs. Schimmel of Leipzic give the following description of musk seed oil:—Specific gravity ·900 at 25° C., it solidifies at a temperature below 10° C., and contains a free fatty acid which partially separates even at the ordinary temperature. This acid is not myristic, but probably palmitic acid. In the distillation the oil partially decomposes; the distillate is strongly acid and contains free acetic and fatty acid. The oil after being freed from the fatty acid remains liquid at 0° C. (*Report, October*, 1887.)

Commerce.—The seeds do not appear to be exported from India; those from the W. Indies fetch about 6 pence per lb, at Mincing Lane.

HIBISCUS CANCELLATUS, *Roxb.*, var. *esculentus, Linn.*

Fig.—*Bentl. and Trim.*, *t.* 36. Esculent Okro, Gombo (*Eng.*), Ketmia comestible (*Fr.*).

Hab.—Cultivated in all tropical countries. The fruit.

Vernacular.—Rám-turai (*Hind.*), Bhenda (*Mar.*), Vendaik-kay (*Tam.*), Dheras (*Beng.*), Bhindu (*Gus.*), Bendekai (*Can.*), Benda-káya (*Tel.*).

History, Uses, &c.—It is doubtful whether this plant is a native of India. Sir J. Hooker seems inclined to think that it is. By some it is thought to be the Tindisha of Sanskrit writers, but the name Bhinda occurs in Sanskrit and probably refers to this plant. The Arabs and Persians call it Bámiya; according to Ibn Baitar, Abul-Abbas describes its cultivation and use in Egypt as a vegetable. The Egyptians make a kind of polenta of the cooked, dried, and powdered fruit, called Naffé. The author of the Makhzan-el-Adwiya states that it is called in Bengal Vilayatí-palwal, and in Hindustani Bhendí, and that it is in India considered to be aphrodisiac. The modern Bengali name is Dhéras. Palwal is the *Trichosanthes dioica,* the fruit of which is of a somewhat similar shape to that of *H. esculentus.* In like manner a similarity of shape with the fruit of *Luffa acutangula* (Turai) has given rise to the Hindustani name Rámturai. Mahometan writers describe it as cold and moist and beneficial to people of a hot temperament. Roxburgh considers it to be nourishing as well as mucilaginous, and recommends it as a valuable soothing and demulcent remedy in irritation of the throat caused by coughing. In the Bengal Dispensatory a lozenge is recommended. Finally, in the Pharmacopœia of India, the immature capsules have been made official for the preparation of the decoction, which is intended to be used as an emollient, demulcent and diuretic in catarrhal affections, ardor urinæ, dysuria, and gonorrhœa.

Description.—The fresh immature capsules are from 4—12 inches in length, about an inch in diameter at the base, tapering, furrowed, somewhat bristly, particularly at the ridges, which correspond in number with that of the cells and valves, *viz.*, from 5—8, with a single row of smooth round seeds in each cell, abounding in a copious, bland, viscid mucilage, which exists more or less in all parts of the plant.

Microscopic structure.—The hairs of the fruit are peculiar, the base consisting of one large cell, to which a number of small cells are attached; in the middle and outer zone of the pericarp are large cavities filled with mucilage.

Chemical composition.—Popp has examined the fresh capsules. He states that they abound in pectin, starch and mucilage. When dried they afforded from 2—2·4 per cent. of nitrogen, and an ash rich in salts of lime, potash, and magnesia. The ripe seeds gave 2·4—2·5 per cent. of nitrogen; their ash 24 per cent. of phosphoric acid. (*Archiv. der Pharmacie*, CXCV., 1871, 142.)

Commerce.—No part of the plant is an article of commerce in India, but the seeds are kept in the shops for sale to gardeners, &c.

HIBISCUS SUBDARIFFA, *Linn.*

Fig.—*Cav. Diss. vi., t.* 198, *f.* 1. Red Sorrell, Rozelle (*Eng.*), Oseille de Guinée, Ketmie acide (*Fr.*).

Hab.—Cultivated in the tropics.

Vernacular.—Patwa (*Hind.*), Lál-ambárí (*Mar.*), Civappukaycurai (*Tam.*), Pundisoppu (*Can.*).

Description.—This plant is cultivated in several parts of India. The fleshy red calyx is used as a fruit, and when dried as an acid article of diet like tamarinds. A jelly not unlike red currant is also made from it. In bilious conditions a diet drink is made by boiling it with water and adding a little salt, pepper, asafœtida and molasses; the French make an astringent syrup with it. The seeds are an excellent food for cattle, and the stems yield tow; the leaves are emollient. The cultivation is attended with very little expense, the seed being sown at the commencement of the rainy reason and the crop ripening at its close. In this plant and in *H. cannabinus* we have the emollient and demulcent properties of the Malvaceæ combined with a large amount of acidity which stimulates and at the same time neutralizes the bilious excretion.

Chemical composition.—The dried calices yielded to analysis —Water 8·29, watery extract 65·96, cellulose 7·68, insoluble

ash 3·88, soluble ash 2·44, alkalinity of soluble ash as potash ·75, tartaric acid 9·90, remaining free acid as malic acid 15·54—total free acid per 100 parts dry substance 27·44. (*Lyon*, 1882.)

HIBISCUS CANNABINUS, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 190. Hemp-leaved Hibiscus (*Eng.*), Ketmia à feuilles de Chanvre (*Fr.*).

Hab.—Western India. Cultivated in most tropical countries.

Vernacular.—Ambârí (*Mar.*), Pâtsan, Rattiasan (*Hind.*), Mesta-pât (*Beng.*), Palungi, Puliccakirai (*Tam.*), Gonkura (*Tel.*), Holada (*Can.*), Sujjâdo (*Sind.*).

Description, Uses, &c.—The plant is extensively cultivated for its fibre (Dukhaní hemp), and the leaves are used as a potherb. One tola of the juice of the flowers, with sugar and black pepper, is a popular remedy for biliousness. The seeds of this plant yield an edible oil, and would appear to be the Hab-el-zalim of Persia. Haji Zein describes the plant which produces them as like hemp, having white flowers like a mallow with purple stamens, pod prickly, seeds like cardamom seeds, with a black skin and white kernel. He says they are aphrodisiac and fattening. There are two other kinds of Hab-el-zalim, *viz.*, Artichoke seeds, and the fruit of *Habzelia æthiopica*, the Hab-el-zalim of Serapion or Monkey Pepper, formerly used as a substitute for pepper.

THESPESIA POPULNEA, *Corr.*

Fig.—*Wight Ic., t.* 8; *Bedd. Fl. Syl., t.* 63. Portia tree (*Eng.*), Thespésia à feuilles de peuplier (*Fr.*).

Hab.—Tropical shores of Bengal, Ceylon, and both Peninsulas. The bark and fruit.

Vernacular.—Páras-pipal (*Hind.*), Bhendi (*Mar.*), Purasha-maram (*Tam.*), Kandarola-mara (*Can.*), Gangarenu-chettu (*Tel.*), Porash (*Beng.*), Párasa-piplo (*Guz.*).

History, Uses, &c.—This tree is much valued on account of the toughness of its timber, which is used for carriage building. It is the *Hibiscus populneus* of Rumphius (III. 31), who speaks highly of the value of the heart-wood as a remedy in bilious attacks and colic, and in a kind of pleurodynia from which the Malays often suffer. The fruit abounds in a viscid yellow juice of the colour of gamboge, which the natives use as an external application in psoriasis. The leaves are applied to inflamed and swollen joints. The tree is called in Sanskrit Párisa and Gardhabhánda; it is noticed by Ainslie, who says that a decoction of the bark is given internally as an alterative to the extent of 3—4 ounces twice daily. The author of the Bengal Dispensatory also notices it, but expresses no opinion as to its properties. Several trials with this remedy were made by the Editor of the Pharmacopœia of India in scabies and other cutaneous diseases; in some cases it exercised a favourable influence, but in the majority it was productive of little or no benefit.

According to Braunt (*Animal and Veget. Fats and Oils*) the seeds contain a dark red oil, known as "huile amère" which is stated to be used for medicinal purposes.

Description.—The capsule is about 1¼ inch in diameter, oblong, depressed, scaly, ultimately glabrescent, coriaceous, 4-celled, each cell being divided by a partial dissepiment into two parts; seeds the size of a pea, pilose, cotyledons conduplicate, radicle thick, the capsule abounds in viscid yellow juice, which is contained in lacunæ in the inner soft portion. This juice when mixed with water forms a primrose-coloured emulsion, which is not precipitated by oxalate of ammonia, sulphuric acid, chloride of barium, or subacetate of lead. On the addition of Liq. potassæ and alcohol, the emulsion becomes transparent and retains its yellow colour; on the addition of sulphuric acid to the clear potash solution, the colouring matter separates as a curdy precipitate of a greenish yellow colour which floats upon the surface. The heart-wood is of a purplish-red colour and has a pleasant odour; it is very hard,

but splits readily. It yields hardly anything to water, but forms a deep purplish-red tincture with alcohol, which on evaporation leaves an astringent, brittle extract like kino.

Chemical composition.—The heart-wood of *Thespesia populnea* contains a garnet-red resin which can easily be separated by digesting the wood in diluted alkali and using hydrochloric acid to precipitate it from the filtered solution. The resin is insoluble in water, but perfectly soluble in alcohol, chloroform and the alkalies, and partly in ether and benzol. Its solution in spirit forms a dark greenish-brown colour with ferric chloride, and it is precipitated by lead salts. Water extracts scarcely anything from the wood. It leaves after complete ignition about 3 per cent. of mineral constituents.

BOMBAX MALABARICUM, *DC.*

Fig.—*Wight Ill., t.* 29; *Bedd. Fl. Syl., t.* 82. Red silk-cotton tree (*Eng.*), Bombax de Malabar (*Fr.*).

Hab.—Tropical India. The gum and root.

Vernacular.—Semul, Rakta-semul (*Hind.*), Rokto-semul (*Beng.*), Saur, Sauri (*Mar.*), Mul-ilava-maram (*Tam., Mal.*), Mullaburaga-mara (*Can.*), Mundla-buraga-chettu (*Tel.*), Shemalo (*Guz.*). The gum, Mocha-ras, Supari-ka-phul (*Hind., Bomb.*), Mocha-ras (*Tam., Tel., Can.*).

History, Uses, &c.—*B. malabaricum,* in Sanskrit Sálmali, and Mocha, is a large tree, covered with stout, hard conical prickles, on which account it bears the Sanskrit synonym of Kantakadruma. In the Mahabhárata it is related that Pitámáha after having created the world, reposed under the tree Sálmali, and in the code of Yajnavalkya it is mentioned as one of the trees of the infernal regions (yamadruma), because it makes a great show of flowers, but produces no fruit fit to eat. At the end of the cold season this tree is a very remarkable object, being entirely destitute of leaves, and loaded with large, red, cup-shaped flowers, which are followed

by egg-shaped, green capsules, containing numerous brown seeds having an average weight of 4-5th of a grain, and a quantity of fine silky cotton. Hindu and Mahometan writers state that the root of the young tree (*músla-semul*), when about as large as a carrot, has restorative, astringent and alterative properties; powdered and mixed with sugar, *ghi* and the juice of the fresh root, it is made into a *pák* or confection which has a reputation as an aphrodisiac, and as a restorative in phthisis and other wasting diseases. In some parts of India the root of the white-silk cotton tree (*Eriodendron anfractuosum*) is preferred for this purpose. This tree is the *Lanifera arbor* of Clusius, the pods of which were first brought to Holland about the end of the 16th century; its cotton is the Capock fibre of the Dutch, and the tree, like the Bombax, yields a dark-coloured opaque gum, insoluble in water, which is used as an astringent in bowel complaints. The natives regard *E. anfractuosum* as a variety of the Bombax, and call it Sveta-sálmali or "white Sálmali" in Sanskrit. In Hindi it is Safed-semul, in Marathi Pándhra-saur, in Guzerati Dolo-shemalo, &c., all names which have a similar meaning. In Madras the young fruits are dried and used as a demulcent and astringent. The gum of the Bombax is very astringent, and is used by both Hindus and Mahometans in diarrhœa, dysentery, and menorrhagia in doses of from 40—50 grains for an adult. Sálmali veshta or Mocha-ras (juice of mocha) only exudes from portions of the bark which have been injured by decay or insects; incisions in the healthy bark produce nothing.

Description.—When first exuded it is a whitish fungous mass, which gradually turns red, and finally dries into brittle mahogany-coloured tears. The larger tears are hollow in the centre, the cavity being produced during the gradual drying of the jelly-like mass which first exudes. Dry Mocha-ras when soaked in water swells up, and resumes very much the appearance of the fresh exudation. The taste is purely astringent like tannin.

Mocha-ras is not a normal juice, but the product of a diseased action, which consists in a proliferation of the parenchyme

cells of the bark; upon making a section of the diseased part, a number of small cavities are seen, which contain a semi-transparent jelly-like substance, consisting of oblong cells containing a little granular matter and a small group of starch cells. At the margin of the cavity the columns of healthy cells are seen breaking up, and the cells separating to join the jelly-like mass; this gradually increases in size and finds its way to the surface to be extruded as Mocha-ras.

The young roots are of a yellowish white colour when the bark has been removed, and are soft, mucilaginous and feebly astringent; grated and mixed with water they yield abundance of nearly colourless mucilage.

Chemical composition.—Mocha-ras when macerated in water affords a reddish-brown solution, which yields a very copious dirty green precipitate with ferric salts, the solution contains a little gum, which is precipitated by alcohol; the bulk of the exudation remains undissolved.

The seeds of *B. malabaricum* yield 25 per cent. of a sweet non-drying oil; it is of a light yellowish brown colour, and commences to deposit fats at 20° C., when it has a specific gravity of 0·9173. The crystalline insoluble fatty acids of the oil amount to 92·8 per cent., and melt at 41°.

The cake of the seeds of *E. anfractuosum* and that of cotton seeds has been examined by Reinders with the following comparative results:—

	Kapok cake.	Cotton cake.
Water	13·28	12·60
Nitrogenous (albuminous) compounds	26·34	20·62
Fat	5·82	6·36
Non-nitrogenous extractive matter	19·92	35·42
Woody fibre	28·12	20·36
Ash	6·52	5·64

The ash from Kapok cake contains 28·5 per cent. of phosphoric acid and 24·6 per cent. of potash.

Commerce.—Mocha-ras or Supari-ka-phúl* is collected by Bheels and other wild tribes. It is sold by all the druggists. Value, Rs. 4 per Surat maund of 37½ lbs. The gum of Moringa is frequently mixed with Mocha-ras; though similar in colour, it may readily be distinguished by its weight and solidity.

ADANSONIA DIGITATA, *Linn.*

Fig.—*Cav. Diss. v.*, 298, *t.* 15. Monkey Bread tree (*Eng.*), Calebassier (*Fr.*)

Hab.—Africa. Cultivated in India. The fruit, bark and leaves.

Vernacular.—Gorakh-amli, Háthi-khatiyán (*Hind.*), Gorakh-chinch (*Mar.*), Papparappuli, Anaipuliya-maram (*Tam.*), Sumpura (*Guz.*).

History, Uses, &c.—This tree, remarkable for the enormous size of its trunk, was first described by Aloysius Cadamosto, a Venetian, in 1454, from one he saw growing at the mouth of the Senegal river, which measured 112 feet in circumference. At Senegal it is called El-omarah and Oufa, and the fruit El-kongles. Prosper Alpinus figures it, and notices that the powdered pulp was sold as Terra Lemnia to those unacquainted with the genuine article; it was eaten with sugar as a cooling medicine in febrile disorders. (*For an account of Terra Lemnia, see P. Bellonius, Obs. I.*, 28.) At the present time the pulp is a component of certain pastiles famous in Turkey, and supposed to contain this earth. Adanson, whose name the genus bears, and who travelled in Senegal in 1794, saw two trees, from 5 to 6 feet in diameter,

* Supári is the fruit of *Areca Catechu*, but children masticate instead of it the blunt thorns of *B. malabaricum*, to which they give the name of supári. In this way the gum has come to be called *Supári-ka-phul*, which has misled some into supposing Mocha-ras to be the produce of the Areca.

on the bark of which were cut a number of European names; two of these were dated, the one in the 14th, the other in the 15th century. In 1555, the same trees were seen by Thevet, another French traveller, who mentions them in his Travels. Livingstone saw the tree in the neighbourhood of Lake Ngami, where it is called *Mowana*. In India it has been introduced by the Arabians, and is common on the Western Coast and near many Mahometan towns; they call it Bahobab, Habhab or Habhabu. The Indian names Gorakh-amli and Gorakh-chinch, signify Gorakh's tamarind; Gorakh was a celebrated Hindu ascetic. Háthi-khatíyán is Elephant's flax, a name given to the tree on account of the great strength of the fibre prepared from its bark. Mr. A. Rea, of the Archæological Survey of India, describes a curious old tree at Chezala, in the Kistna district, standing in the court of a Buddhist chaitya, which has a hollow core, and is popularly supposed to grow from out of a subterranean cave. It is known as Peruleni-pedda-manu, or "the nameless great tree." Around the base is a platform 25 ft. by 22 ft. 6 in and 3 ft. high. The circumference of the trunk at that height is 53 ft. 6 in; the first branches are 9 ft. 6 in. from the ground, and there the girth is 56 ft. The spread of the foliage is 78 ft. across, and the height of the tree is about 87 ft. In Africa as in India the shell of the fruit is used for various economic purposes, such as floats for fishing nets, water bottles, &c. In Africa the pulp and seeds are used as a food, and as a medicine in dysentery, and the young leaves, which are very mucilaginous, are made into poultices and used as a fomentation to painful swellings. The leaves dried and reduced to powder are called *Lalo* by the Africans, and are used to check excessive perspiration. The Duchassaings of Guadeloupe have recommended the bark in fever: they say it is cooling, lessens the frequency of the pulse, and increases the appetite. It may be given in decoction, 30 grammes in a litre of water, boiled down to two-thirds. (*Corre et Lejanne. Mat. Med. Coloniale.*) Dr. Rançon in his thesis on "La dyssenterie endémique des pays chauds et notamment au Sénégal" (Faculté de Lyon, 1886,) says—"Le

pain de singe est considéré par les indigènes comme le médicament anti-dyssentérique par excellence. Il est mélangé aux aliments mêmes. Ainsi, l'indigéne se nourrit surtout de bouillie de farine de mil avec du lait caillé. On désigne ce mélange sous le nom de *Sanglé.* Lorsqu'il est atteint par la dyssenterie, le nègre mélange le pain de singe à cette bouillie."

Dr. Garnier in his thesis "Souvenirs médicaux du poste du Sedhion (Cazamance)" Faculté de Montpellier, 1888, says of the Baobab: "Il est utilisé dans l'alimentation par les noirs, qui l'ajoutent au couscous; dans la thérapeutique, par les mulâtres, contre la diarrhée ou la dyssenterie. Il nous a été loisible de l'expérimenter plusieurs fois dans la première affection, et si nous n'avons pas relevé d'action efficace bien marquée, nous ne lui avons pas trouvé non plus d'inconvénients. Il nous a paru agir comme substance rafraîchissante, tempérante, *se rapprochant du tartrate de potasse.* Quelque peu de pulpe en macération dans l'eau donne une tisane fort agréable et calme bien la soif, dans la fièvre, par exemple. Ses feuilles sont mucilagineuses et émollientes, on les emploie fraîches ou sèches. Sous cette dernière forme, c'est le *Lalo* des nègres. Étant au bout de notre provision de tourteaux de graines de lin, nous nous en sommes maintes fois servi avec succès, suivant le conseil d'un commercant de Sedhion, pour remplacer l'émollient Européen." In India the pulp mixed with buttermilk is used as an astringent in diarrhœa and dysentery. In the Concan the pulp with figs is given in asthma, and a sherbet made of it, with the addition of cummin and sugar, is administered in bilious dyspepsia. It is also given for this affection with emblic myrobalans, fresh mint, rock salt and long pepper. Modern research shows that the pulp is aperient and demulcent, the leaves demulcent with slight astringency and the bark demulcent and astringent, the astringency being due to the presence of tannin.

From an article in the "Bulletin de la Société Philomatique de Paris (1822, p. 103,) it would appear that the pulp of the Baobab was used in Europe up to the commencement of the

present century as a remedy for dysentery. The ash of the pericarp is used in Africa for the manufacture of soap.

Description.—The fruit varies much both in shape and size; some specimens correspond with the description given by Adanson, and others with that of Guibourt, that is to say, they are either cucumber-shaped or bottle-shaped, and from 6 to 18 inches in length. The shell is hard, woody and light, clothed with a dull green felt-like down, composed of simple hairs; it is made up of regularly arranged wood cells intersected here and there by vascular bundles. The fruit is full of sub-acid pulp, which is divided by fibrous bands into a number of compartments. The pulp dries up into a starch-like powder of a reddish-white colour, which adheres together in polyhedral masses, a seed forming the centre of each mass; it consists chiefly of mucilage-cells and contains no starch. The seeds are enclosed in a horny shell, having a rusty-red, rough exterior; they are kidney-shaped and half an inch in length. The bark has a scabrous epidermis, and on section shows a mottled yellowish-green and reddish-brown surface; internally it is intimately united with the woody fibre of the trunk. The fresh bark when wounded yields a white semi-fluid gum, which is odourless and tasteless, and has an acid reaction; it is insoluble in water. The ash contains a large quantity of lime. Mr. J. G. Prebble has brought to our notice that this gum when examined under the microscope is seen to be full of well-formed clustered crystals of calcium oxalate; there are also some highly refractive globules of oil or oleo-resin. With age the gum eventually becomes reddish-brown.

Microscopic structure.—A transverse section of the leaf shows that the upper surface consists of a single row of large cells, which swell when boiled, but develop no mucilage. Beneath this is a parenchyme of cells containing chlorophyll, except over the central nerve, where chlorophyll is absent and the cells are broken down to form a large lacuna or depôt of mucilage; similar cells and smaller lacunæ are seen beneath the nerve to the number of four or five. Over the secondary nerves

there are similar cells and a single lacuna. The rest of the parenchyme is cellular and of no special interest. The lower surface of the leaf is composed of a row of small cells which yield no mucilage on boiling.

A transverse section of the young stem shows an epidermis and scanty suber, beneath which are a number of rows of tangentially extended cells, and then two or three rows of parenchyme cells containing chlorophyll and oil globules, amongst which are some cells containing crystals of calcium oxalate. Next comes a thick liber, in which are groups of stone cells and some cells containing calcium oxalate. The wood is porous, and the pith also shows cells containing oxalate. In the old bark, in the cells beneath the chlorophyll cells, are tangentially extended lacunæ containing mucilage, which absorb a large part of the tissue; the suber and liber are much developed, and large groups of stone cells are seen in connection with the medullary rays. (*Heckel and Schlagdenhauffen.*)

Chemical composition.—Mixed with water and treated with a drop of iodised iodide of potassium, the pulp is not coloured blue or yellow, showing the absence of starch and albumenoid principles, but the water forms a mucilage which, when filtered and treated with alcohol, yields an abundant gelatinous precipitate. It is also precipitated by neutral plumbic acetate, chloride of zinc, ferric chloride, and the chlorides of barium, strontium, and lime. The watery solution has an acid reaction, and when treated with nitric acid yields mucic and oxalic acids. The pulp exhausted by petroleum ether affords a light yellow extract, which contains traces of resin, is insoluble in water, and is not coloured by ferric chloride; chloroform removes from it a similar extract, but of a greenish colour, owing to the presence of a trace of chlorophyll. The alcoholic extract is of a reddish-brown colour and partly soluble in water; the insoluble portion re-dissolved in alcohol is coloured bluish-green by ferric chloride; the soluble portion is coloured red by the same reagent, and reduces freely Fehling's solution. According to Heckel and Schlagdenhauffen, the following is the composition of the pulp:—

Principles soluble in petroleum ether and chloroform...0·0530			
Principles soluble in alcohol ....9·9783	{	2·4370	phlobaphenes
		5·5753	glucose
		1·9660	tartaric acid and traces of alkaline acetate
Principles soluble in water.......... .. 54·2840	{	8·8397	glucose
		33·6623	mucilage and gum
		11·7820	bitartrate of potash
Ash by difference 35·6847	{	32·2350	woody and colouring matter
		3·4497	salts
100 000		100·000	

The pericarp of the fruit according to Heckel and Schlagdenhauffen contains :—

Water..	12·176
Alcoholic extract : colouring matters, albuminoids, phlobaphene.	3·860
Watery extract : albuminoids, colouring matters, salts, and gummy matters..	7·357
Ash : fixed salts, chiefly carbonate of potash and soda	5·258
Woody tissue (by difference)	71·258
	100·000

The leaves examined by the same chemists were found to have the following composition :—

Soluble in petroleum ether ...	Wax	1·450
Soluble in alcohol	Glucose	1·625
	Wax	3·245
	Salts	0·755
	Undetermined matters...........	2·225
Soluble in water, gummy and albuminous matters		20·31
Ash, chiefly chloride of sodium, and carbonates of potash and soda		4·55
Lignin, by difference...		65·84
		100·00

Messrs. Heckel and Schlagdenhauffen found no trace of an alkaloid in the bark, nor of any such substance as saponin, or the adansonin of Wittstein and Walz. Its composition was—

Soluble in petroleum ether ...	Wax	0·425
Soluble in alcohol	Wax	3·0375
	Insoluble tannin	2·2925
	Soluble tannin	0·7825
	Chloride of sodium	0·08
Soluble in water, gummy and albuminous matters..................		1·35
Ash, chiefly chloride of sodium and carbonates of potash and soda		6·2905
Lignin, by difference		85·742
		100·00

—(*Les Nouveaux Remèdes*, 1888, *pp.* 385, 481.)

PAVONIA ODORATA, *Willd.*

Fig.—*Wall. Cat.* 1886, 1, 2. *D., E.*

Hab.—N.-W. Provinces, Sind, W. Peninsula, Burmah, Ceylon.

Vernacular.—Sugandha-bala (*Hind.*), Bala (*Beng.*), Kálá-vålá (*Mar.*), Perámútiver (*Tam.*), Bálarakkasi-gida (*Can.*).

History, Uses, &c.—This plant is called Bala and Hrivera in Sanskrit. The root is used in Hindu medicine to prepare a fever drink known as *Shadanga paniya,* which is made by boiling one drachm each of the roots of *Andropogon muricatus* and *Cyperus rotundus* or *pertenuis,* Red Sandalwood, the herb of *Oldenlandia herbacea,* the roots of *Pavonia odorata,* and dry ginger, in two sérs of water down to one sér. It is considered to be cooling and stomachic. The genus Pavonia is named after Don Josef Pavon, a botanical traveller in Peru. Ainslie (*Mat. Med. ii.,* 297,) notices the use of *P. odorata* by the Hindus, but expresses no opinion as to its medicinal properties. In Bombay, Serpentary root imported from Europe, is universally substituted for this drug. In *P. odorata,* as in the Musk Mallow, the mucilaginous properties of the genus are combined with an odorous matter having the stimulating and carminative action of musk.

Description.—Roots 7 to 8 inches long, more or less twisted, not more than ¼ inch in diameter at the thickest part; giving off numerous thin fibres and having a delicate musky odour. Bark light brown, nearly smooth, wood hard, yellowish. The plant has the musky odour of the roots; it is herbaceous, erect, and covered with sticky hairs. Flowers pink; carpels obovoid, size of a small pea; seeds brown, oily, not musky.

GOSSYPIUM STOCKSII, *Mast.*, var. herbaceum, *Linn.*

Fig.—*Wight Ic., t.* 9, 11; *Royle Ill., t.* 23. Cotton plant (*Eng.*), Cotonnier (*Fr.*).

Hab.—Sindh. Cultivated in most hot countries.

Vernacular.—Kapás (*Hind.*, *Mar.*), Vona (*Guz.*), Paruthi (*Tam.*), Hatti-gida (*Can.*), Karpás (*Beng.*), Patti-chettu, Kárpásamu (*Tel.*).

History, Uses, &c.—Cotton, the Karpási of Sanskrit writers, was doubtless first known and made use of by the Hindus; it is the βυσσος of the later Greek writers, such as Philostratus* and Pausanias,† but not of the earlier Greeks, who applied this term to a fine kind of flax used for making mummy cloths. Theophrastus‡ calls it Eriophora, Pliny Gossympinus, Gossypion, and Xylinum.§ In Arabic cotton is called قطن and قرفس (Kuttun and Kurfus), the latter term being evidently derived from the Sanskrit. Eastern physicians consider all parts of the cotton plant to be hot and moist; a syrup of the flowers is prescribed in hypochondriasis on account of its stimulating and exhilarant effect; a poultice of them is applied to burns and scalds. Cotton cloth or mixed fabrics of cotton with wool or silk are recommended as the most healthy for wear. Burnt cotton is applied to sores and wounds to promote healthy granulation; dropsical or paralysed limbs are wrapped in cotton after the application of a ginger or zedoary *lép* (plaster); pounded cotton seed, mixed with ginger and water, is applied in orchitis. Cotton is also used as a moxa, and the seeds as a laxative, expectorant, and aphrodisiac. The juice of the leaves is considered a good remedy in dysentery, and the leaves with oil are applied as a plaster to gouty joints; a hip bath of the young leaves and roots is recommended in uterine colic. In the Concan the root of the *Deokapás* (fairy or sacred cotton bush) rubbed to a paste with the juice of patchouli leaves, has a reputation as a promoter of granulation in wounds, and the juice of the leaves made into a paste with the seeds of *Vernonia anthelmintica* is applied to eruptions of the skin following fever. In Pudukota the leaves ground and mixed with milk are given for strangury.

Cotton root bark is official in the United States Pharmacopœia, also a fluid extract of the bark; it appears to have first attracted

* 71. † VI., 26. ‡ H. P. IV., 9. § 19, 2.

attention from being used by the female negroes to produce abortion. There appears to be little doubt that it acts like ergot upon the uterus, and is useful in dysmenorrhœa and suppression of the menses when produced by cold; a decoction of 4 ounces of the bark in two pints of water boiled down to one pint may be used in doses of two ounces every 20 or 30 minutes, or the fiuid extract may be prescribed in doses of from 30 to 60 minims. Cotton seed tea is given in dysentery in America; the seeds are also reputed to be galactagogue. (*Stillé and Maisch., Nat. Disp., p.* 678.) By treating cotton first with a dilute alkali, then with a 5 per cent. solution of chloride of lime, and lastly with water acidulated with hydrochloric acid, and afterwards well washing it with water, it loses its greasiness and becomes absorbent and a valuable dressing for wounds; this absorbent cotton may be medicated by sprinkling it with solutions of carbolic acid, salicylic acid, boracic acid, &c. Pyroxylin or Gun Cotton is made by dipping cotton into a mixture of equal parts of nitric and sulphuric acids, washing freely with water, and drying.

Description.—Cotton root bark is in bands or quilled pieces, one half a line thick, covered with a brownish-yellow, satiny, very thin cork, by the abrasion of which irregular, dull, brownish orange patches appear. The cork forms slight longitudinal ridges, which are often confluent into elongated meshes, and marked with black circular dots or short transverse lines. The inner surface is whitish or reddish white, of a nearly silky lustre, and finely striate in a longitudinal direction by the thin medullary rays. The bast fibres are long and tough, arranged in tangential rows, and are separated without difficulty in very thin layers. The bark breaks with difficulty in a transverse direction, but is readily torn longitudinally. It is without odour and without taste, with the exception of a very slight acridity and faint astringency. (*Stillé and Maisch.*)

Chemical composition.—The bark contains *starch,* and when fresh, according to W. A. Taylor (1876), a *chromogen,* which dissolves in alcohol with a pale yellow colour, gradually chang-

ing to a bright brownish-red. The same change takes place on keeping the bark for some time, when it yields a red tincture with alcohol. This substance was examined by Prof. Wayne (1872) and W. C. Staehle (1878), who regard it as of a resinous nature. The latter obtained about 8 per cent. of this substance, which is soluble in 14 parts of alcohol, 15 of chloroform, 23 of ether, and 122 of benzol; also in alkalies, from which solutions it is again precipitated by acid. The potassa solution diluted with water is of a sage green tint. Glucose was likewise observed, and the aqueous solution of the alcoholic extract contained a principle which gave a purplish-black precipitate with ferric chloride. C. C. Drueding (1877) obtained also a yellow resin soluble in petroleum-benzine, a fixed oil, a little tannin and 6 per cent. of ash. (*Stillé and Maisch.*) Cotton seeds are small in size, and vary from ellipsoid to fusiform, and in colour from pale grey through yellow and brown to almost black. Of forty samples examined the amount of oil varied between 10 per cent. in an immature and badly dried Sea Island seed, to 29 per cent. in fully matured Egyptian seed. The albuminoids and other nitrogenous substances varied from 18 to 25 per cent., and the lignin from 15 to 25 per cent. One hundred pounds of seed give on an average—

Hills with lint	49—46	pounds.
Cake	38—37	„
Oil	16—14	„

The crude oil has 28 to 30 times the viscosity of water. At 20° C. it has a specific gravity of ·9283 and at 15° C. of ·9306. It congeals at —1°·9 C. to —2°·7 C. In taste and odour it resembles linseed oil, and in other properties it is intermediate between a drying and a non-drying oil. The refined oil has a specific gravity of ·9264 at 15° C. and congeals at ·0°C. to —1·°1 C. Chemically cotton seed oil consist of palmatin and olein, and its ultimate percentage composition is carbon 76·40, Hydrogen 11·40, Oxygen 12·20. (*Brannt.*) Cotton seed oil is not suitable for pharmaceutical purposes.

Commerce.—Cotton root bark is not an article of commerce in India; it may be obtained fresh in most parts of the country. Cotton seed oil is largely manufactured in the United States; in 1888 the Atalanta mills pressed 15,000 tons of seed, obtaining 4,668,750 pounds of oil, worth 30 cents a gallon, or 7½ lbs.

The meal obtained was 10,331,250 lbs. and 300,000 lbs. of lint cotton were removed from the seeds before expressing the oil. The lint was worth 18,000 dollars, and the meal which is used as a manure 88,603,58 dollars.

The following plants belonging to the Malvaceæ are also used medicinally on account of their mucilaginous properties:—

Hibiscus tiliaceus, *Linn.*, **Malva parviflora,** *Linn.*, **Malachra capitata,** *Linn.*, **Urena lobata,** *Linn.*, and **Kydia calycina,** *Roxb.* The bark of the last named plant is used in sugar refinery. It is a remarkable bark abounding in gum; the gum comes from the liber, where the layers may be separated like pieces of lace; on scraping away the outer layer, the gum is seen protruding between the longitudinally disposed fibres. In the *Pharmacographia* it is stated that Althæa gum occurs in cells; in this bark it appears to be formed from cellulose, as the cells seem to be disrupted, and the cell walls absorbed.

STERCULIACEÆ.

STERCULIA URENS, *Roxb.*

Fig.—*Roxb. Cor. Pl. I.* 25, *t.* 24.

Hab.—Throughout India, Ceylon. The gum.

Vernacular.—Bali, Gúlú, Kúlú, Karai, Kalru (*Hind.*), Karai (*Guz.*), Pándrúk, Kávali, Kandúl (*Mar.*), Penári (*Can.*), Kávali, Tabsu (*Tel.*), Vellay-putali (*Tam.*).

History, Uses, &c.—It is uncertain whether this tree is mentioned by Sanskrit writers, as it appears to have been

confounded with *Cochlospermum Gossypium,* which yields a similar gum. Possibly it may be the tree spoken of as Balika. The gum is collected for sale in most parts of India, and is largely used for making native sweetmeats, and as a substitute for tragacanth. The seeds yield an oil containing much stearin (*Hawkes*), and are eaten by the Ghonds and Kukus in the Central Provinces. (*Brandis.*)

It has been shown by Van Tieghem that "in the Sterculiaceæ the gum is produced in large secretory cells formed by the separation of contiguous cells. These cells surrounding the canals are surrounded by smaller cells, which become dissociated as the canal enlarges, and so altered in appearance as to be scarcely recognizable. In *Cola acuminata* the gum canals are present in the pith and bark." (*Bull. Soc. Botanique de France,* p. 11, and *Pharm. Journ.* (3), xv., 893.)

Description.—On cutting off a young branch of *Sterculia urens* the gum is seen exuding as a soft solid mass from very large canals in the pith and bark, and it appears to be contained in the tissues with some tension as the gum is extruded in a short time to the extent of about half an inch. The very young portions of the trees, as the branches of the panicled inflorescence and the petioles of the leaves also extrude the gum. The gum is completely soluble in cold water, forming an almost colourless solution. Seen in volume it is slightly opalescent. Thirty grains dissolved in twenty ounces of water forms a thick, tasteless, mucilage, which entirely passes through a paper filter. A solution of this strength, examined in a column 200 m.m. long, was optically inactive, neutral to litmus, and not precipitated by alcohol. A very thick mucilage is, however, precipitated. It is gelatinized by basic acetate, and gives a faint precipitate with neutral acetate of lead, but is unaffected by ferric chloride or borax and not coloured blue by iodine. It is precipitated by boiling with an alkaline solution of cupric tartrate, but the copper is not reduced. The gum treated with nitric acid yields abundant crystals of mucic acid. It loses 16 per cent. of water by

drying at 100° C., and on incineration yields about 4 per cent. of ash. Examined under the microscope, no starch can be detected, but a few small polygonal parenchyme cells are usually to be met with. The mucilage possesses little or no adhesive power.

From some comparative experiments made with cod-liver and castor oils it appears to be about equal to tragacanth as an emulsifying agent. (*J. G. Prebble.*)

Commerce.—The gum exudes most abundantly in the cold weather, and is collected by the forest tribes. Value about Rs. 12 per cwt.

In China the fruits of **Sterculia scaphigera,** *Wall.*, are used on account of the large quantity of gum, which they contain under the name of *Ta-hai-tsze.* They were introduced into France as a cure for dysentery under the name of *Boa-tam-paijang,* but were found to act simply as a demulcent. These fruits are from ¾ to 1½ in. long, ovoid, usually somewhat elongated at the lower extremity, which terminates by a large oblique cicatrix. Externally they are of a dark-brown, deeply wrinkled, though generally less so at the superior extremity. The pericarp, which is from $\frac{1}{10}$ to $\frac{1}{20}$ of an inch in thickness, consists of a thin epidermis, beneath which lies a dry, black, resinous-looking pulp, surrounding a fragile shell lined with a whitish membrane. The central portion of the fruit is occupied by two cotyledons, which in their dried state are thin and concave. When the fruit is macerated in water, its outer shell, or pericarp, increases enormously in volume, forming a large gelatinous mass. (*See Hanbury's Science Papers, p. 235, where a figure of the fruit will be found.*) Guibourt found in the pericarp, green oil 1·06, bassorin 59·04, brown astringent matter and mucilage 1·60, woody fibre and epidermis 3·20; and in the nucleus, fatty matter 2·98, saline and bitter extractive 0·21, starch and cellular tissue 31·91 per cent.

Several species of sterculia afford large oily seeds, which are eaten by the natives. Of these, *S. fœtida, Linn.*; *Wight Ic.*,

t. t. 181, 364, may be taken as a type. It is a large tree of the Western Peninsula, Concan, Malabar, Burma, and Ceylon, and is often called "wild almond" in the vernaculars. The Tamils also call it Kudrap dukku, from the resemblance of its large follicle to the testicles of a horse. The seeds are elliptic, about an inch long, and half an inch in diameter, covered with a loose black parchment, and having a yellow caruncle at the base. A white felt-like layer covers the hard black shell, which is brown and velvety within, and encloses an oily white kernel of the same shape as the seed. Each seed weighs about two grams. The shells are difficult to powder. The felt-like skin softens in water like bassorin. The kernels contain about 40 per cent. of fixed oil and a large quantity of starch.

Loureiro states that the bark of this tree is aperient, diaphoretic, and diuretic, and is given in dropsy and rheumatism by the Chinese. The flowers are remarkable for their stercoraceous odour.

The fixed oil of *Sterculia fœtida* is thick, pale yellow, bland, and non-drying. It commences to deposit crystalline solid fats at 18° C., and the whole congeals at about 8°. The specific gravity at 15·5° is ·9277. Saponification equivalent 266·2. The crystalline fatty acids melt at 29° to 30°. With sulphuric acid it forms a thick orange-red mixture. With cold nitric acid it becomes opaque and slightly deepens in colour; when heated with the acid, it changes to a deep coffee-brown. The portion of the lead soap of the fatty acids, insoluble in ether, amounted to 68·9 per cent., and the liberated acid without any purification had a melting point approximating that of stearic acid. The fatty acids from the lead soap, soluble in ether, consisted of oleic with a small quantity of lauric acid.

HELICTERES ISORA, *Linn.*

Fig.—*Wight Ic., t.* 180; *Rheede Hort. Mal. vi., t.* 30. East Indian Screw tree (*Eng.*).

Hab.—Central and Western India and Western Peninsula, Ceylon. The fruit and root.

Vernacular.—Marori, Marorphali (*Hind.*), Mriga-shinga (*Guz.*), Kevani, Varkáti, Dhámani (*Mar.*), Valumbirikai (*Tam.*), Atmorha (*Beng.*).

History, Uses, &c.—This is a tall shrub, or small tree, much resembling the common hazel; the flowers, which are bright red and showy, appear in the rains. In Sanskrit it is called Avartani and Mriga-shinga or "deer's horn." The peculiar twisted form of the carpels has probably led to its use as a medicine according to the ancient doctrine of signatures. Ainslie notices its use by the Hindus as a remedy for offensive sores inside the ears. At the present time it enters into most prescriptions for the cure of griping in the bowels and flatulence, especially in the case of children. Its chief virtue seems to be its harmlessness. It is indispensable at the marriage ceremonies of the Vaisya caste, being tied upon the wrist of bride and bridegroom along with the fruit of *Randia dumetorum.* Persian names for it are Kisht-bar-kisht and Pechak. It is the Kisht-bar-kisht of Ibn Sína, who describes it as hot and dry in the third degree. In the Concan the root-bark is prescribed in diabetes. We have been unable to discover that this plant has any properties beyond those of a demulcent and wild astringent. The roots may be used as a substitute for althæa.

Description.—The fruit consists of five slender angular carpels, twisted like a corkscrew, and together forming a cone about 1½ to 2 inches long. The carpels are pubescent, and of a greenish brown colour; they contain a single row of dark brown angular seeds. The internal surface is of a light greenish hue and highly polished; taste mucilaginous. The root bark is of a dark-brown colour, and is very thickly studded with small round warts so as to present almost the appearance of Shagreen.

Commerce.—The fruit is kept in all druggists' shops, and as a domestic remedy is perhaps one of the best known articles in

the Hindu Materia Medica. Value, Rs. 3½ per Surat maund of 37½ lbs.

Pterospermum suberifolium, *Lam. Ill., t.* 576, *f.* II., Muchkand (*Hind.*), bears white fragrant flowers, which rubbed into a paste with kángika (rice vinegar) are an ancient and well known Hindu remedy for hemicrania. The Sanskrit name of the plant is Muchukunda, which appears to be derived from मुच्, Greek μυσσω, Latin mungo, whence mucus, and कुन्द a sweet-smelling flower. The flowers render water gelatinous.

P. acerifolium, another species, is called in Sanskrit Karnikára, in Hindi Kaniár and Katha-champa, and in Bengali Kanakchampa. In Sikkim it is known as Hathipaila, and the hill people use the white tomentum from the under surface of the leaf to stop bleeding. In the Concan the flowers and bark of these trees are charred and mixed with Kamala, and applied in suppurating small-pox. Karnikára is mentioned by Kálidása as "a flame of the woods." The tree he alludes to is evidently *Cassia Fistula,* which also bears this name in Sanskrit.

ABROMA AUGUSTA, *Lam.*

Fig.—*Lam. Ill., t.* 636 *and* 637. Devil's Cotton (*Eng.*).

Hab.—India and the East. Native or cultivated. The root.

Vernacular.—Ulat-kambal (*Beng.*), Olak-tambol (*Bomb.*).

History, Uses, &c.—This shrub has long been known as a plant yielding a valuable fibre (*Royle's Fibrous Plants of India, p.* 267). In 1872, Mr. Bhoobun Mohun Sircar (*Ind. Med. Gaz.*) first called attention to the use of the root as an emmenagogue in Bengal, and recommended the fresh viscid sap in the treatment of dysmenorrhœa in doses of 30 grains. Subsequently Dr. Kirton recommended the use of drachm doses of the root

beat into a paste with water. Dr. Watt in his "Dictionary of the Economic Products of India" records the opinion of thirteen medical men regarding the medicinal properties of the plant; of these, eight speak favourably of it. Dr. R. Macleod says:—"It is a valuable medicine in dysmenorrhœa, the fresh root is usually given, made into a paste with black pepper about a week before the time of menstruation, and is continued until it commences. I have seen it prove very efficacious in some cases, especially in the congestive form of the disease." Dr. Thornton says:—"The slender roots are useful in the congestive and neuralgic varieties of dysmenorrhœa. It regulates the menstrual flow and acts as a uterine tonic. It should be given during menstruation, 1½ drachms of the fresh root for a dose with black pepper, the latter acting as a stomachic and carminative." Dr. Evers says:—"It has never failed in my hands in speedily relieving painful dysmenorrhœa." In Western and Southern India the plant is not common, and its medicinal properties do not appear to be known.

Description.—A small tree or shrub, with soft velvety branches, and ovate-oblong, serrulate leaves, the under surface of which is tomentose. The flowers are dark purple and drooping, and have five petals with dilated claws. The fruit is a dry, 5-celled capsule, with 5 truncated wings. When ripe it dehisces at the apex, exposing the five inner angles of the cells crested with stiff silky hairs which penetrate and irritate the skin if handled. Each cell contains numerous black seeds the size of radish seeds. The roots have a thick, fibrous, brown bark, which, when freshly cut, protrudes a thick gummy substance like others of the genus. (*See Sterculia urens.*)

Chemical composition.—The bark was separated from the dried roots and reduced to powder. Dried at 100° C. the powder lost 5·37 per cent. of moisture. The ash calculated on the undried powder amounted to 11·64 per cent. There was nothing special to note regarding the composition of the ash; it did not contain manganese.

Treated with light petroleum ether 0·4 per cent. of a yellow soft extract was obtained, which was odourless and tasteless. In cold alcohol it was partly soluble, the solution possessing an acid reaction, and leaving on spontaneous evaporation an indistinctly crystalline residue. The portion insoluble in cold alcohol was white and had the physical properties of a wax.

After the action of petroleum ether, the powder was dried and exhausted with ether, which yielded on evaporation ·88 per cent. of yellow odourless non-crystalline extractive. This extract was insoluble in water and in dilute acids. In alcohol it was partially soluble with acid reaction. In alcoholic ammonia the extract was almost wholly soluble, the solution being of a yellow colour: the addition of acids to the ammoniacal solution caused the separation of whitish flocks. The ether extract gave no reaction with iron salts.

After removal of ether from the powder, it was treated with absolute alcohol, and on evaporating off the spirit 1 per cent. of a yellow non-crystalline extract was left. This extract was slightly soluble in water, with acid reaction; by the action of dilute sulphuric acid, a yellowish solution was obtained, and a yellow insoluble residue left. The acid solution did not give any reaction with alkaloidal reagents. The residue insoluble in dilute acid was wholly soluble in aqueous ammonia, the resulting solution being of a deep yellow colour: the addition of acids caused the precipitation of yellowish white flocks which were easily soluble in chloroform. A portion of the original alcoholic extract gave no reaction with iron salts. The powder after exhaustion with alcohol was dried. When treated with water the dry powder formed a viscid mass; by the action of boiling water the mucilage partly dissolved, the solution did not gelatinize on cooling. A trace of starch was present.

PENTAPETES PHŒNICEA, *Linn.*

Fig.—*Rheede, Hort. Mal. x.*, t. 56; *Cav. Diss.* iii., t. 43, *f.* 1.

Hab.—Throughout the hotter parts of India.

Vernacular.—Dopahariya (*Hind.*), Kát-lálá, Bándhuli (*Beng.*), Tambri-dupári (*Mar.*), Nága-pú (*Tam.*)

A large annual (4 to 5 ft.) found in rice-fields and other wet places during the monsoon. It is the Naga-pu of Rheede. The capsules of this plant are used medicinally on account of their mucilaginous properties; they are subglobose, bristly, 5-celled, 5-valved, about half the length of the persistent interior calyx, which is 5-partite and bristly. Each cell contains from 8 to 12 seeds arranged in two vertical rows. (*See Gärtn. Fr., t.* 134.) The plant appears to have attracted the attention of the Hindus on account of its peculiar habit and time of flowering, and has many Sanskrit names, such as Bandhuka and Bandhujiva, living in association or groups; Arka-vallabha, beloved of the sun; Pushparakta, red-flowered, &c.

TILIACEÆ.

CORCHORUS TRILOCULARIS, *Linn.*

Fig.—*Jacq. Vind.* 2, *t.* 173. Trilocular Jew's Mallow (*Eng.*), Corete triloculaire (*Fr.*).

Hab.—Asia, Africa. The seeds.

Vernacular.—Kurrú Chuntz (*Mar.*), Pát (*Hind., Beng.*), Peratti-kirai (*Tam.*), Parinta (*Tel.*). The seeds, Raja-jíra (*Guz.*).

History, Uses, &c.—*C. trilocularis* is a small annual plant which appears in the rainy season along with *C. olitorius*, from which it may be distinguished by its oblong, lanceolate leaves, trilocular capsules, and small seeds; both plants are known by the name Nádika in Sanskrit. Ainslie mentions the latter plant as being used medicinally by the Hindus, and says that they reduce it to ashes and mix it with honey for administration in obstructions of the abdominal viscera. He also notices its use as a pot-herb. According to Twining, an infusion of the leaves forms a useful fever drink. In India

the seeds of *C. trilocularis*, which are bitter, are administered in doses of about 80 grains in fever and obstructions of the abdominal viscera. A bitter corchorus was known to the Greeks. Theophrastus says ὁ παροιμιαζόμενος διὰ τὴν πικρότητα κόρχορος. (H. P., VII. 7.) Pliny (21, 106) also mentions Corchorus as a poor kind of pulse growing wild.

Description.—The seeds, which are closely packed in the trilocular capsule, are small, black and angular; they are generally more or less mixed with those of *C. olitorius*, which may easily be distinguished by their greater size ($\frac{1}{10}$th of an inch) and peculiar shape, which resembles that of a mooring buoy.

Corchorus fascicularis, *Lam.*, a native of tropical India, Australia and Africa, is a small procumbent woody plant with oblong or lanceolote serrated leaves; peduncles 2—5 flowered, opposite to the leaves; capsules linear oblong, nearly terete, rostrate, three-celled, about half an inch long, clothed with simple hairs; they contained a number of small dark-brown angular seeds. The whole plant is sold in the shops; it is very mucilaginous and somewhat astringent, and is valued as a restorative. Hirankhorí is the name given to it by the country people, and means deer's hoof. In the Calcutta and Bombay shops it is called Bhaphalí, which name must not be confounded with Bhaphalí, the Marathi name for *Peucedanum grande*, an umbelliferous plant.

C. fascicularis has been received from Poona under the name of *Magarmithi*. *C. Antichorus, Ræusch., Wight Ic.* 1073, is also sold as Baphalí.

GREWIA TILIÆFOLIA, *Vahl.*

Fig.—*Beddome, Fl. Syl., t.* 108.

Hab.—Western India to the Himalayas, Burma, Ceylon.

Vernacular.—Dhámaní (*Hind., Beng.*), Dháman (*Mar.*), Thada, Tharra (*Tam.*), Charachi (*Tel.*), Butale (*Can.*).

History, Uses, &c.—A tree, leaves hoary beneath, oblique cordate, dentate, 5-nerved, feather veined, petioles 1 inch, pubescent, thickened at the top, stipules leafy, falcate acuminate, auricled on one side, flowers yellow. The berries have an agreeable acid flavour and are eaten. Bark thick, white internally, covered externally by a thin grey suber which readily peels off, showing a slightly rough, green surface beneath, very mucilaginous and sweetish to the taste. In the Concan the bark, after removal of the suber, is rubbed down with water and the thick mucilage strained from it and given in 5 tolá doses with 2 tolás of the flour of *Panicum miliaceum*, as a remedy for dysentery. The Sanskrit name of the tree is Dharmana, and this name is loosely applied to several species of Grewia.

The bark of **G. asiatica**, *Linn.*, has similar properties. The tree is called Parusha in Sanskrit, Phalsa in Hindi, Shukri in Bengali, Phalshi in Marathi, and Putiki in Telugu. It is cultivated for its acid fruit, which is one of the *phala-traya* or fruit triad of Sanskrit writers. (See *Pomegranate*.)

Grewia scabrophylla, *Roxb.*, with scabrous leaves, stem and fruit, Khatkhati (*Mar.*), is given in accordance with the doctrine of signatures as a remedy for leprosy in the Concan; it appears to be simply mucilaginous like most of the genus. Its roots are the althéa of the Portuguese in Goa, and are used as a substitute for Althæa.

Triumfetta.—The plants belonging to this genus are mucilaginous, and are used as demulcents.

The burr-like fruit is said to promote parturition. **T. rhomboidea**, *Jacq.*, often confounded with *Sida* (see *Malvaceæ*) by the natives, is generally used. The plants of this genus are the Lappuliers of the French colonies, and bear the significant names of *Herbe à cousin*, *pou de moine*, and *téte à nègre*.

LINEÆ.

LINUM USITATISSIMUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 39. Common Flax (*Eng.*), Lin usuel (*Fr.*).

Hab.—Egypt. Cultivated in India. The seeds and oil.

Vernacular.—Alsí, Tisí (*Hind.*), Alishi-virai (*Tam.*), Mosiná (*Beng.*), Alashi, Javas (*Mar.*), Atasi, Madana-gingelu (*Tel.*), Alashi (*Can.*).

History, Uses, &c —Linseed, called in Sanskrit Atasí, appears to have been but little used as a medicine by the Hindus. The Mahometans have paid more attention to the plant; they consider it to be cold and dry, and that clothes made with the fibre cool the body and lessen perspiration; they recommend fumigation with the smoke for colds in the head and hysteria, and use the tinder to staunch hæmorrhages. Sherriff says if you wish to become thin wear washed linen clothes in the summer but not in winter. The flowers are said to be cardiacal, the seeds aphrodisiacal, and hot and dry. Linseed poultice is recommended for gouty and rheumatic swellings; as an emollient the mucilage is dropped into the eye; with honey it is prescribed in coughs and colds. The roasted seeds are said to be astringent. In Western India, the unripe fruit is used as a vegetable. Flückiger and Hanbury in their *Pharmacographia* (p. 89) give a summary of the history of the plant in the West, and trace its use back to the 23rd century, B. C. It is the λίνον of Dioscorides and the Linum of Pliny.* Gallesky (1767) strongly advocated the use of Linseed oil in painter's colic and other spasmodic affections of the bowels. In modern medicine Linseed tea is much used as a demulcent drink in cough depending upon an

* Dios. ii., 94. Plin. 19; 1. 20; 92.

irritated and inflamed condition of the pharynx and upper part of the respiratory passages. It is also useful in irritation of the intestinal canal and urinary passages. The meal is one of our best poultice materials. The oil with an equal part of lime water forms the well known application for burns and scalds called Carron oil, and is also given internally as an aperient in piles, dose two ounces, morning and evening. Formerly the oil boiled to the consistence of caoutchouc was used for the manufacture of bougies, catheters, and elastic probes. By interrupting the burning linseed oil by covering the boiler, there remains a brown turpentine-like substance, the so-called *birdlime.* (*Brannt.*)

Description.—The capsule, which is globose, splits into 5 carpels, each containing two seeds separated by a partition. The seeds are of a flattened elongated ovoid form, with an acute edge, and a slightly oblique point blunt at one end. They have a brown glossy polished surface, which under a lens is seen to be marked with extremely fine pits. The hilum occupies a slight hollow in the edge just below the apex. The testa encloses a thin layer of albumen surrounding a pair of large cotyledons having at their pointed extremity a strait embryo. The seeds of different countries vary from $\frac{1}{4}$—$\frac{1}{6}$ of an inch in length, those produced in warm regions being the largest. In India a white variety is sometimes met with. When immersed in water, the seeds become surrounded by a thin, slippery, colourless mucous envelope, which quickly dissolves as a neutral jelly, while the seed slightly swells and loses its polish. (*Pharmacographia,* p 90.)

Chemical composition.—The following summary is extracted from the *Pharmacographia* :—"The constituent of chief importance is the fixed oil which the seed contains to about $\frac{1}{3}$rd of its weight. The proportion obtained by pressure on a large scale is 20—30 per cent. The oil when pressed without heat and when fresh has but little colour, is without unpleasant taste and does not solidify till cooled to —20° C. The commercial oil is dark yellow, and has a sharp repulsive taste and

odour. On exposure to the air, especially after having been heated with oxide of lead, it quickly dries up to a transparent varnish, consisting chiefly of linoxyn, $C^{32} H^{54} O^{11}$. The crude oil increases in weight 11—12 per cent., although at the same time its glycerine is destroyed by oxidation.

"By saponification, Linseed oil yields glycerin, and 95 per cent. of fatty acids, consisting chiefly of linoleic acid, $C^{16} H^{26} O^{2}$, accompanied by some oleic, palmitic and myristic acid. The action of the air transforms linoleic acid into the resinoid oxylinoleic acid, $C^{16} H^{26} O^{5}$. Linoleic acid appears to be contained in all drying oils; notably in that of poppy seed. It is not homologous either with ordinary fatty acids, or with the oleic acid of oil of almonds, $C^{18} H^{34} O^{2}$.

"The viscid mucilage of Linseed cannot be filtered till it has been boiled. It contains in the dry state more than 10 per cent. of mineral substances, when freed from which and dried at 110° C., it corresponds, like althæa mucilage, to the formula $C^{12} H^{20} O^{10}$. The seeds by exhaustion with cold or warm water afford of it about 15 per cent. By boiling nitric acid it yields crystals of mucic acid. Its chemical relations are therefore those of gum and not of soluble cellulose. Linseed contains about 4 per cent. of nitrogen, corresponding to about 25 per cent. of protein substances; after expression of the oil, these substances remain in the cake.

"In the ripe state, Linseed is altogether destitute of starch, though this substance is found in the immature seed in the very cells which subsequently yield the mucilage. The water retained by the air-dry seed is about 9 per cent. The mineral constituents of Linseed, chiefly phosphates of potassium, magnesium, and calcium, amount on an average to 3 per cent. and pass into the mucilage. By treating thin slices of the testa and its adhering inner membrane with ferrous sulphate, it is seen that this tegument contains a small quantity of tannin." A. Jorissen has pointed out that a mixture of linseed meal and warm water, when kept at a temperature of 25° C., and then distilled, yields a distillate containing

containing hydrocyanic acid. (*Bull. Acad. Roy. Belg.* (3) V., 750.) The oil is obtained by three methods, cold drawn, by the aid of heat and expression, and by the use of solvents. Seeds 2 to 6 months old are generally used, as the oil from fresh seeds is viscous and turbid. (*Brannt.*) Four qualities of oil are produced, raw, refined, boiled, and artist's oil.

Commerce.—In 1872, India exported to the United Kingdom £1,144,942 worth of Linseed. In 1882 the total exports were valued at more than £3,000,000, and in 1885-86 and 87 the average value of the exports was nearly £5,000,000.

ERYTHROXYLON MONOGYNUM, *Roxb.*

Fig.—*Cor. Pl. i. t.* 88; *Wight Ill. t.* 48.

Hab.—Hilly parts of the Western Peninsula, Ceylon. Red Cedar, Bastard Sandal (*Eng.*).

Vernacular.—Tevadarum, Devadarum (*Tam.*), Adavi-gorânti (*Can.*).

E. monogynum is a shrub with pale bark and cuneate obovate leaves, the primary nerves of which are hardly distinguishable from the secondary, which latter are not connected with the intra-marginal nerve. The leaves of this plant are refrigerant, and were largely eaten during the famine in the Madras Presidency, in 1877, by the natives of several districts where it grew wild in abundance, and it was thought probable that they might be found to contain an alkaloid with properties similar to that which is obtained from *E. Coca.* Dr. Cornish just before he left India wrote to ask Mr. Lawson to have the subject investigated, and several consignments of the leaves from the Cuddapah district, were sent to the Government Quinologist for analysis, who found that they contain no anæsthetic principle at all analagous to Cocaine, but a bitter and tonic alkaloid which may have mitigated the pangs of hunger. Squibb's method was used in examining these leaves,

and by the same method, no difficulty was found in obtaining Cocaine from *E. Coca* grown in India. The wood is fragrant, whence the name Bastard Cedar, and the bark is used as a tonic in the Madura district.

Hugonia Mystax, *Linn., Rheede Hort. Mal. ii., t.* 19; *Wight Ill. i., t.* 32, is a rambling, leafy, tomentose shrub, with yellow flowers, found in the Western Peninsula from the Concan to Travancore, and in Ceylon. According to Rheede, who calls it *Modera canni,* the bruised roots are used to reduce inflammatory tumours and internally as a febrifuge and anthelmintic.

ZYGOPHYLLEÆ.

TRIBULUS TERRESTRIS, *Linn.*

Fig.—*Wight Ic., t.* 98. Small Caltrops (*Eng.*).

Hab.—India and other warm countries. The fruit and root.

Vernacular.—Chota Gokhrú (*Hind.*), Gokhuri (*Beng.*), Lahana Gokhru (*Mar.*), Nerunji (*Tam.*), Negalu-gida (*Can.*), Mitha Gokhru, Beththa Gokhru (*Guz.*). Palleru-mullu, Chiru-palleru (*Tel.*).

History, Uses, &c.—This plant is the Gokshura and Ikshugandha of Sanskrit writers; the first of these names signifies "cow's hoof" from the resemblance of the cocci when adhering together in pairs, as is frequently the case, to a cloven hoof, the second alludes to the aroma of the plant. The Hindus use the fruit and root; they regard them as having cooling, diuretic, tonic and aphrodisiac properties, and use them in gonorrhœa and dysuria. The root is one of the ten drugs which go to form the Dasamula Kvatha, a compound decoction often mentioned in Sanskrit works. The ten plants are *Desmodium gangeticum, Uraria lagopodioides, Solanum*

Jacquini, Solanum indicum, Tribulus terrestris, Ægle Marmelos, Calosanthes indica, Gmelina arborea, Stereospermum suaveolens, and *Premna spinosa.* The first five of these are called Hrasva (or laghu) pancha mula, or the five minor plants, and the last five, Vrihat pancha mula, or the five major plants. According to Loureiro, *T. terrestris* is astringent.

It is the Khasak or Hasak of the Arabs and Persians; and is well described by Ainslie, who says:—"It is a common plant near the Dardanelles, and is called in modern Greek τριβόλια. Dioscorides calls it τρίβολος and Pliny tribulus; they both describe two kinds, '*terrestris*' and '*aquaticus*.' The latter is the *Trapa natans, Linn.,* or Water Chestnut.* In the Pharmacopœia of India the use of *T. terrestris* as a diuretic in Southern India is noticed." In Pudukota the flowers rubbed with silver are applied in inflammation of the cornea. The action of this drug on the mucous membrane of the urinary passages appears to resemble closely that of Buchu and Uva Ursi; it may often be advantageously combined with opium and hyoscyamus.

Description.—*Tribulus terrestris* has a slender fibrous root, 4 to 5 inches long, cylindrical, and of a light brown colour; the odour is faintly aromatic and the taste sweetish and astringent. From the root spring four to five delicate stalks, spreading flat on the ground; these are hairy and extend to 2½ feet in length; the leaves are pinnated, leaflets 5 to 6 pairs, nearly round. The flowers are axillary on short peduncles, and composed of five broad obtuse yellow petals; these are succeeded by a roundish five-cornered fruit, about the size of a marble, armed with prickles; this ripening divides into five cells, each armed with 4 strong sharp thorns

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* Dios. iv., 16. Plin. 21, 58; 22, 12. Professor Flückiger has drawn attention to the abundance of manganese in this plant, a fact which has been demonstrated by Gorup-Besanez. *Trapa bicornis* of China and *Trapa bispinosa* of India (Singhâra) resemble it in this respect; they are largely used as articles of food in the East, and considered cooling in bilious affections with diarrhœa.

and containing several seeds. The cocci are wedge-shaped, yellowish when ripe, the external convex surface being rough between the thorns. When all five are *in situ*, the fruit presents ten thorns pointing towards the peduncle, and ten pointing outwards round the circumference; the latter are developed first. This may account for the statement in some books that each coccus has only two spines. The seeds are oily, and enclosed in very hard stony cells. The taste is faintly aromatic and rather agreeable.

Chemical composition.—An ethereal or an alcoholic extract of the powdered fruits yields to water a crystalline residue containing a body precipitated from its solutions by ammonia and having the properties of an alkaloid, and associated with hydrochloric acid or alkaline chlorides. The fruits also contain a fat and a resin, the latter probably is the source of the aroma of the drug, as it gives off a fragrant odour when burnt. The fruits contain a rather large quantity (14·9 per cent.) of mineral matter.

Commerce—The fruit is collected in the sandy districts of India; it is always obtainable in the drug marts. Value, Rs. 5 per Surat maund of 37½ lbs.

Tribulus Alatus, *Delile. Boiss. Fl. Orient.* I., 902. Winged Caltrops (*Eng.*). *Vernacular.*—Nindotrikund, Latak (*Sind*), Hasak (*Punj.*). The fruits are used for the same purpose as those of *Tribulus terrestris.* The plant is common in Sind, the Punjab, and Beloochistan. Fruit pyramidal, broadly winged; cocci hirsute, two-seeded; spines confluent. (*Murray.*)

FAGONIA ARABICA, *Linn.*

Fig.—*Wight Ill. i., t.* 64.

Hab.—N.-W. India, Sind, Punjab, W. Peninsula, Egypt. The plant.

Vernacular.—Dhamása (*Bomb.*), Ustarkhár (*Hind.*), Dramahui (*Sind.*).

History, Uses, &c.—This plant is common on grain fields in the Punjab and Deccan; it is suffrutescent, much branched, with opposite two-stipuled leaves; the stipules are often thorny; leaflets linear-cuspidate; the wood of the stem is white and very hard, covered with a ragged, light brown bark, which becomes slimy and mucilaginous when moistened; taste mucilaginous. On account of the prickly nature of the plant it is called in Sanskrit Dusparsha, or "painful to the touch." Dhamása has a great reputation as a suppurative in cases of abscess from thorns, &c.; it is also used for cooling the mouth in stomatitis, the juice being boiled with sugar-candy until quite thick, and a small quantity allowed to dissolve in the mouth frequently; the juice is thought to prevent suppuration when applied to open wounds. Fagonia in Sind and Afghanistan is a popular remedy for fever among the Hill people, and Dr. J. L. Stewart states that *F. Bruguieri, DC.*, is used for the same purpose in the Peshawar valley, and is given to children as a prophylactic against small-pox. It is known by the same vernacular names as *F. arabica.*

GERANIACEÆ.

OXALIS CORNICULATA, *Linn.*

Fig.—*Wight Ic.*, *t.* 18; *Fl. Græc.*, t. 451. Horned Wood-Sorrell (*Eng.*), Oxalide corniculée (*Fr.*).

Hab.—A weed of cultivation, Asia, Europe, &c. The plant.

Vernacular.—Amrulsák, Chuka-tripati (*Hind.*, *Beng.*), Ambutí, Bhuí-sarpatí (*Bomb.*), Puli-yárai (*Tam.*). Puli-chintaku (*Tel.*), Pullam-purachi-sappu (*Can.*).

History, Uses, &c.—This plant, called in Sanskrit works Amlalonika and Chángerí, is considered by the Hindus to be cooling, refrigerant, and stomachic. The fresh juice is given to relieve intoxication from Datura, and is said to be useful

in dysentery and prolapsus of the rectum. (*Hindu Materia Medica, Dutt.*) Chakradatta gives the following formula for preparing a ghrita with the herb: *Changeri ghrita*—Take of clarified butter 4 seers, curdled milk (dádhi) 16 seers, leaves of *Oxalis corniculata* beaten into a paste 1 seer. Boil together in the usual way, and prepare a ghrita. The fresh herb made into a poultice with hot water is used as a healing application to various eruptions in the Madras Presidency. In the Concan the plant is rubbed down with water, boiled, and the juice of white onions added: this mixture is applied to the head in bilious headache. Mahometan writers briefly notice the plant as being used by the Hindus. Ainslie describes it, and mentions it use as a cooling medicine in doses of two teaspoonfuls twice a day. The plant is a native of Europe, and is called μοσχοφιλο in modern Greek. In Réunion it is considered a laxative, and is called Petit trèfle.

Description—*O. corniculata* is one of the most troublesome garden weeds in India; the stems are decumbent, rooting; leaves palmately trifoliolate; leaflets obcordate, pubescent; peduncles 2 to 5-flowered; flowers yellow, capsule linear, oblong, many-seeded, densely pubescent; seeds transversely ribbed. All parts of the plant have an acid taste.

Chemical composition.—The different species of Oxalis contain acid potassium oxalate.

Biophytum Sensitivum, *DC. Bot. Reg. xxxi., t.* 68, is a native of Tropical India, Asia, Africa and America.

Vernacular.—Làjri (*Mar.*), Zarir (*Guz.*), Lajàlu (*Hind.*).

This plant is used in incantations. Rumphius sub voce Gallinaria says of it—"Ipse enim Acosta narrat et declarat doctum Bracmanem ipsi spopondisse sub conditione magni certaminis, sese per hanc herbulam effecturum ut mulier, quam desideraret, illum sequeretur, ille autem tam honestus erat ut hasce artes Christianis vetitas, nollet addiscere, nec scriptis suis inscrere." Rheede says of it, "the seeds are red and

shining, and are powdered and applied to wounds, and with butter to abscesses to promote suppuration, the root in decoction is given in gonorrhœa and lithiasis."

Averrhoa Carambola, *Linn.*, and **A. Bilimbi,** *Linn.*, *Rheede, Hort. Mal. iii.*, 43, 44, 45, are cultivated throughout the hotter parts of India, on account of their acid fruits.

Their native country is uncertain, but some suppose them to have been brought from the Moluccas by the Portuguese, who call them Carambola and Bilimbinos. Like some others of the Geraniaceæ, their leaves are sensitive; their fruits are much used by the natives of India as an acid vegetable, and by Europeans as a tart fruit and preserve. They contain much acid potassium oxalate and are used to remove iron moulds. A syrup of the fruit and a conserve of the flowers are used by the natives as a cooling medicine in fever. *A. Carambola* has a yellow angular fruit about the size of a hen's egg; there are two varieties, sweet and sour. *A. Bilimbi* produces a yellowish-green fruit with five rounded lobes about the size of a gherkin, whence the English name Cucumber-tree.

GERANIUM NEPALENSE, *Sweet.*

Fig.—*Wight Ill. i.*, 153, *t.* 59.

Hab.—Temperate Himalaya, Nilgiris, Ceylon.

Vernacular.—Bhánda (*Hind.*).

GERANIUM OCELLATUM, *Camb.*

Fig.—*Royle, Ill.* 149, 150.

Hab.—Sub-tropical Himalaya, Behar, on Parisnath.

Vernacular.—Bhánda (*Hind.*).

GERANIUM WALLICHIANUM, *Sweet.*

Fig.—*Wight Ic.* t. 324.

Hab.—Temperate Himalaya, Kuram Valley, Afghanistan.

Vernacular.—Mámirán (*Afghan.*).

A plant called γερανιον is mentioned by Dioscorides (iii. 122,) having a fruit like the the head of a crane (γερανος); it appears to have been used as an astringent in certain affections of the vagina. Pliny (26, 68) mentions three kinds of this plant which have been identified with *Erodium moschatum, Aiton, Geranium molle, Linn.*, and *Geranium tuberosum, Linn.*

Geranium Robertianum, Linn., Herb Robert (*Eng.*), Bec de grue, Robertin (*Fr.*), a native of Europe and of the West temperate Himalaya, was formerly used in Europe as a vulnerary in hæmorrhages, and as an application to tumours and ulcers; internally it was given in gravel, jaundice and ague. It has a strong odour and a bitter, saline and astringent taste. In America *Geranium maculatum, Linn.*, a native of Canada and the United States, is official, and the root is known as *Alum root*; it contains tannic and gallic acids (*Tilden*), to which it owes its medicinal properties. (*Fig.—Bentl. and Trim.* 42.)

The Indian Geraniums used medicinally, the names of which are placed at the head of this article, have the astringent properties common to the genus. The root of *G. nepalense* affords abundance of red colouring matter, and is used for colouring medicinal oils like alkanet (Ratanjot).

Aitchison in his article upon the Kuram Valley Flora observes that the root of *G. Wallichianum* is called Mámirán by the Afghans, and is used as an astringent application to the eyes. (*Journ. Linn. Soc.*, xviii., p. 26.)

The Arabs call the wild Geraniums Ibrat-ur-raai or Shepherd's needle.

RUTACEÆ.

RUTA GRAVEOLENS, *Linn.*, var. *angustifolia.*

Fig.—*Bot. Mag.* 2311. Garden Rue (*Eng.*), Rue des jardins (*Fr.*).

Hab.—Cultivated in the East. The herb.

Vernacular.—Sudáb (*Hind., Mar., Guz.*), Arvada (*Tam.*), Sadápa, Arudu (*Tel.*), Núgadali-sappu (*Can.*).

History, Uses, &c.—Rue was held in high estimation by the Greeks and Romans. Aristotle in his *History of Animals* (ix. 6) tells us that the weasel before fighting with serpents, rubs itself against this plant. Hippocrates considered it to be resolvent and diuretic, and notices it in his chapter on female diseases. Pliny notices it in several parts of his Natural History, and calls it one of the best medicinal herbs. Celsus says of Rue, "Urinam movet, sensus excitat, purgat, mollit." Apuleius (*De Ver. Herb.*) recommends the following superstitious practise "ad profluvium mulieris"; "Herbam rutam circumscribe auro et argento et ebore, et sublatam eam alligabis infra talum." Macer Floridus states that Mithridates, king of Pontus, used rue as a protection against poison:—

> "Obstat pota mero vel cruda comesta venenis.
> Hoc Metridates rex Ponti sæpe probavit,
> Qui Rutæ foliis, &c."

Johnston, in his *Thaumatographia Naturalis*, writes:—"Ruta libidinem in viris extinguit, auget in feminis." The plant was hung round the neck in the Middle Ages as a charm against vertigo and epilepsy; it was considered emblematic of good luck, and a protection against sorcery, a herb dear to women, &c. (*De Gubernatis.*)

The Hindus received the plant from the West along with the superstitions connected with it; they burn the leaves for the purpose of fumigating young children suffering from catarrh, and use a tincture of them as an external remedy in paralytic affections, and administer them internally in dyspepsia. They consider rue injurious to pregnant women, an opinion expressed by Dioscorides.

The Arabians class rue among their attenuentia, vesicatoria and stimulantia. The author of the Makhzan-el-Adwiya describes three kinds—garden, wild, and mountain rue. He considers it to be hot and dry in the third degree, to increase the mental powers, to act as a tonic and digestive, and to increase the urinary and menstrual excretions. He also states that it acts as an antaphrodisiac and causes abortion

when given to pregnant women. The diseases in which it is recommended are so numerous that we must refer the reader to his article "Sudáb." The old European physicians considered rue to be antispasmodic, stimulant and emmenagogue, and prescribed it in hysteria and flatulent colic. Boerhaave extols its virtues in promoting perspiration.

Rue is the *Herb Grace* of old English writers, and is still much used as a domestic remedy. Alibert says of it, "Cette plante a un grande action sur le système nerveux, et particulièrement sur le système uterin. Beaucoup de femmes en prennent dans les menstrues laborieuses." The dose of the powdered leaves is from ten grains to a scruple or more, twice or thrice daily. Rue occupies a corner in most Indian gardens. It is largely grown near Grasse in France, 150 to 200 lbs. produce 1 lb. of oil.

Rue is an active irritant, whether applied externally or taken internally. It has been frequently used with success to procure abortion; sometimes it produces painful vomiting, always great prostration, confusion of mind, cloudy vision, feebleness and slowness of pulse, coldness of the extremities, and twitching of the limbs; in pregnant women the drug produces pain in the back, bearing down, and frequent micturition, followed by pains and abortion about ten days after the commencement of its administration. Oil of Rue has been observed to produce similar symptoms with increased frequency and diminished tension of the pulse; on the other hand, when an infusion of the dry leaves was used, the pulse fell from 80 to 69 in three hours.—(*Van de Warker, Criminal Abortion*, 1872.)

Description.—The variety angustifolia is thus described in the *Flora of British India*:—"Leaves petioled, triangular ovate, decompound, segments various, corymbs spreading, bracts lanceolate, sepals triangular acute, petals ciliate, capsule obtuse, shortly pedicelled.

Chemical composition.—The essential oil, when purified by a few rectifications, is somewhat viscid; has a specific gravity of

0·837 at 18°; a strong disagreeable odour, like that of the plant; a slightly bitter aromatic taste; boils at 228°—230°, and solidifies between + 1° and 2°, to shining crystalline laminæ, resembling those obtained from Anise oil. The chief volatile constituents of rue are methyl-nonylketone, and a hydrocarbon. The ketone, separable by alkaline bisulphites, was formerly regarded according to the investigations of Gerhardt and of Cahours, as capric or rutic aldehyde, $C^{10} H^{20} O$. But Greville Williams has shown that the crude oil contains two such compounds, *viz.*, $C^{11} H^{22} O$ and $C^{12} H^{24} O$, the latter in comparatively small quantity; and this result has been confirmed by Harbordt. The portion of rue oil, which does not combine with alkaline bisulphites, is separable into a more volatile portion, having the composition of Turpentine oil, and a less volatile portion, which appears to be isomeric with Borneol, but boils at a lower temperature. For a fuller account of the chemistry of Rue, see *Watt's Dict. of Chem.*, Vol. V., p. 132.

Commerce.—Rue is cultivated in India for medicinal use. It is also imported from Persia. Value, Re. ¼ per lb.

PEGANUM* HARMALA, *Linn.*

Fig.—*Lam. Ill.*, 401. Syrian Rue (*Eng.*), Rue Sauvage (*Fr.*).

Hab.—N.-W. India, Western Deccan. The seeds.

Vernacular.—Hurmal, Hurmaro, Ispand (*Hind.*, *Bomb.*, *Beng.*), Shimai-azha-vanai-virai (*Tam.*), Shima-goranti-vittulu (*Tel.*).

History, Uses, &c.—In native works on Materia Medica, Hurmal is described as an alterative and purifying medicine in atrabilis, and also in diseases supposed to arise from

* πήγανον. The Greeks and Romans speak of two kinds of Peganon or Rue, '*garden*' and '*wild*, or, *mountain Rue*,' and Apuleius Platonicus gives *armala* as the Syrian name of *Ruta hortensis*, or Garden Rue. He mentions Peganon agrion separately, and says the Italians call it *Ruta montana*.

cold humours, such as palsy, lumbago, &c.; it is also said to stimulate the sexual system both in the male and female, increasing the flow of milk and menses in the latter. For administration a concentrated decoction is mixed with sweet oil and honey, or the crushed seeds are boiled in wine down to one-fourth of the original bulk of the latter, and the mixture strained (*vide* Makhzan-el-Adwiya, article Hurmal). Dr. P. Gopal, who has experimented with this drug, informs us that the infusion or tincture acts as a stimulant emmenagogue, and produces slight intoxication like *Cannabis indica.* He gave the tincture in ½ drachm doses to a female suffering from amenorrhœa, and it had the effect of producing a free menstrual discharge; he further says that it is sometimes used by the native midwives to procure abortion. Dr. Gopal believes that it has properties in common with Ergot, Savine, and Rue. The equal activity of watery and spirituous preparations may be explained by the fact that the red resinous colouring matter is a secondary product formed by the oxidation of the alkaloid Harmaline; it is only produced after digestion of the seeds in spirit. In Persia *P. Harmala* is called Sipand; when sprinkled upon burning coals it is supposed to avert the malignant influence of the evil eye. Popular allusions to it in Persian books are frequently met with.

Description.—The drug, as found in the bazaar, consists of the seeds mixed with a few pedicels surmounted by the five-partite calyx and portions of the three-celled, three-furrowed capsule. The seeds are of a dull greyish brown colour, irregularly angular, and about ⅛ of an inch long; they have a heavy narcotic odour when crushed, and a bitter taste.

Microscopic structure—The testa, which is rough and squamous, may be seen to consist of two rows of large honeycombed cells, the walls of which contain brown colouring matter. The kernel is greenish, and when a section is placed in glycerine for examination, it immediately developes a fine

green fluorescence; it consists of two longish cotyledons surrounded by albumen; the cell contents of both appear granular.

Chemical composition.—Some seeds crushed, and treated with water for a few minutes, produced after filtering a pale yellow fluid with a marked green fluorescence; this was destroyed by alkalies and restored by acids. A further examination of the seeds was made by exhausting them with rectified benzine, rectified spirit, and water acidulated with hydrochloric acid. The benzine solution was of a pale yellow colour, and upon evaporation yielded a rich reddish brown oil, having no very marked odour, and a nauseous taste. The tincture made with rectified spirit was of a deep red, like Tra. Lavandulæ Comp., very opaque and highly fluorescent. Upon evaporation it yielded a soft extract of the colour of Dragon's blood, and having the odour of *Cannabis indica*. This, when exhausted with water, gave a pale red solution with a green fluorescence, which, when treated with a solution of oxalate of ammonia, threw down the red colouring matter and became pale yellow. but retained its fluorescence. The remainder of the spirituous extract, after complete exhaustion with water, consisted of a soft resin of a deep carmine lake colour, having a heavy narcotic odour like resin of *Cannabis indica*. The portion treated with acidulated water yielded a pale sherry-coloured fluorescent solution, which, upon evaporation, gave a soft yellow extract, with an odour like honey; the greater part of this dissolved in rectified spirit, forming a yellow fluorescent solution; this, after filtration, was evaporated to a thin syrup, and upon cooling formed a dark brown mass. The seeds contain two alkaloids, *Harmaline*, $C^{13} H^{14} N^{2} O$, discovered by Gobel in 1837, and *Harmine*, $C^{13} H^{12} N^{2} O$, discovered by Fritszche in 1847. The yield of the two alkaloids according to Fritszche is 4 per cent., of which one-third is Harmine and two-thirds Harmaline. These two substances have been recently examined by O. Fisher and E. Tacaber (*Ber. d. Chem. Gesselsch.*, 1885, 400, 406). Harmaline crystallises from its solution in methylic alcohol in yellowish scales little soluble in water or ether,

soluble in cold alcohol, and very soluble in boiling alcohol; it colours the saliva yellow. It melts at 238° C., and is decomposed; heated with strong sulphuric acid it forms Harmaline-sulphuric acid, which on the addition of water, gives a fine blue fluorescence. Treated under pressure with fuming hydrochloric acid it yields *Hermatol,* which forms orange-red crystals sparingly soluble in water. This solution is strongly fluorescent and is probably identical with the yellow colouring matter of the seeds. Harmaline forms with acids crystallizable yellow salts soluble in water, to which they communicate a remarkable fluorescence. Harmine which exists in the seeds, is also obtained by oxidizing Harmaline with nitric acid. It crystallizes in colourless needles almost insoluble in water and very little soluble in cold alcohol or ether; it fuses at 256° C., and is partly sublimed and partly decomposed. Fuming hydrochloric acid converts it into *Harmal,* the acid solution of which is fluorescent. Oxidised by means of chromic acid it yields Herminic acid, $C^{10} H^{8} N^{2} O^{4}$, which crystallizes in silky tufts.

Commerce.—Hurmal seed is imported from Persia, but the plant has been introduced into India by the Mahometans, and in some places has run wild. In Southern India Henna seeds under the name of *Iswand* are used as a substitute for this drug. Value, Rs. 2½ per Surat maund of 37½ lbs.

ZANTHOXYLUM RHETSA, *DC.*

Fig.—*Rheede, Hort. Mal.* v., t. 34. Indian prickly Ash (*Eng.*), Clavalier d'Inde (*Fr.*).

Hab.—Western Peninsula.

Z. ALATUM, *Roxb.*

Hab.—Sub-tropical Himalaya.

Z. ACANTHOPODIUM, *DC.*

Hab.—Sub-tropical Himalaya.

Z. OXYPHYLLUM, *Edgw.*

Hab.—Temperate and sub-tropical Himalaya.

Z. HAMILTONIANUM, *Wall.*

Hab.—Assam and Burma.

Z. BUDRUNGA, *Wall.*

Hab.—Tropical Himalaya.

The carpels.

Vernacular.—*Z. Rhetsa*, Rhetsa-maram (*Tam.*), Rhetsa-maum (*Tel.*), Jimmi-mara (*Can.*), Tisal, Triphal, Chirphal (*Mar.*). *Z. alatum* and *Z. acanthopodium*, Tambul (*Beng.*), Nipáli-dhanya, Tumra, Tejphal, Darmar (*Hind.*). *Z. Budrunga*, Badrang (*Hind.*).

History, Uses, &c.—Sanskrit writers call the carpels of *Z. alatum* and *Z. acanthopodium* by the name of Tumburu, which signifies "coriander"; the fruits of these trees are so similar in appearance that they can hardly be distinguished. They have the peculiar flavour of coriander, and are about the same size as that fruit. In Hindu medicine they are considered to be hot and dry. The Chinese also use the carpels under the name of Hwa-tseaou or "Pepper flower," and in Japan the carpels of *Z. piperitum* are used. The Arabians appear to have obtained the carpels of *Z. alatum* or *acanthopodium* first from Northern India. Ibn Sina under the name of Fághireh (open-mouthed) describes them as "a berry the size of a chick pea containing a black seed as large as a hemp seed, brought from Sakála in Hindustan." Sakala or Sangala was an ancient town in the Punjab, near the modern Sanglawala Tiba or Sangla Hill. It is the Sangala of Alexander, and was visited by the Chinese pilgrim Hwen Thsang in A. D. 630; it had then a large Buddhist monastery and a stupe 200 feet high. Háji Zein el Attár, who wrote A.D. 1368, gives a similar account of Fághireh, and says that the

Persians call it Kabábeh-i-kusháde h (open-mouthed cubebs). The fruits of a *Zanthoxylum* are figured by Clusius under the name of Fagara Avicennæ in his *Arom. Hist.*, Ed. 1605, p. 185, but they are probably those of *Z. Rhetsa*. The true Fagara Avicennæ is the Fagara minor of the old Pharmacologists. Later Mahometan writers speak of a Fághireh coming from South India, and doubtless allude to the carpels of *Z. Rhetsa*, a large tree of the Western Peninsula which derives its botanical name from the Telugu word Rhetsa, "an assembly." Roxburgh tells us that the elders amongst the Telugu people meet under this tree to settle disputes, it is therefore called Rhetsa-maum or "assembly tree." *Z. Budrunga*, a tree of the tropical Himalaya, has carpels which can hardly be distinguished from those of *Z. Rhetsa*. The Mahometan physicians consider Fághireh to be hot and dry, and to have astringent, stimulant, and digestive properties. They prescribe it in dyspepsia arising from atrabilis, and in some forms of diarrhœa. The inhabitants of Southern and Western India use the carpels of *Z. Rhetsa* as a condiment, especially with fish; as a medicine they are given in honey for rheumatism, and the essential oil as a remedy for cholera. These carpels are the Fagara major of the old pharmacologists, and are much larger than those described by Ibn Sina. The fruits of *Z. oxyphyllum* and *Z. Hamiltonianum* are also used: they are so similar to one another in appearance as to be hardly distinguishable. Besides its medicinal uses, Fagara minor is used as an ingredient in *Guráku* (tobacco for the *hukka*), and in the preparation of ground bait for fishing. The bark of these trees is tonic and aromatic, and may be used with advantage in rheumatism and in atonic dyspepsia; the root bark is to be preferred. Heckel and Schlagdenhauffen (*Académie des Sciences, Ap.* 21*st*, 1884,) reported that a crystalline principle, obtained from the bark of a West Indian *Zanthoxylum*, produced in frogs, rabbits, &c., general paralysis and abolition of the functions of respiration and circulation. (*See Berberine, p.* 66.)

Description.—The fruits of *Z. alatum* and *Z. acanthopodium* consist of the carpels usually dehiscing and empty, but

sometimes enclosing the round, black, shining seed. In perfect specimens we find a slender pedicel supporting the carpels, which are nominally four in number, but of which at least one or two are mostly abortive. The carpels are oval or nearly spherical, $\frac{2}{10}$ths of an inch in longest dimension; externally they are of a bright reddish-brown, covered with prominent tubercles filled with oleo-resin; internally they are furnished with a hard, papery, white membrane, which becomes loose, contracts and curls up when the seed falls. The drug has an aromatic taste (at first like coriander) and an agreeable aromatic odour. The fruits of *Z. Rhetsa* and Budrunga are of the same shape, but as large as a pea, and the external surface of the carpel does not show the prominent tubercles above mentioned, but is finely wrinkled, of a reddish-brown colour, and not lined with a hard white papery membrane. The taste is at first like that of lemon peel, but afterwards extremely pungent like that of *Z. alatum,* producing much the effect of Pyrethrum upon the palate. The fruits of *Z. oxyphyllum* and *Z. Hamiltonianum* are of the same size as those of *Z. alatum,* but sessile and without prominent tubercles; they are of reddish-brown colour, and have a fine wrinkled surface like *Z. Rhetsa;* a hard, white papery membrane is present which becomes loose and contracts when the seed falls. In taste they resemble *Z. Rhetsa.* The shining black seeds of all these species have a feeble peppery taste. Sections of the capsules when magnified show that their elasticity is due to the presence of strong bands of spiral fibres. The dry open capsules when soaked in water resume the shape that they had before dehiscence.

The root bark of *Z. Rhetsa* is of a reddish-brown colour, and is covered with a light yellow suber, which easily separates in papery flakes; it has an agreeable aromatic odour and a bitter taste.

Chemical composition.—The bitter crystalline principle present in the bark of the Zanthoxyleæ, and formerly called *Zanthopicrite,* has been recognised as identical with berberine

by Dyson Perrins. (*Trans. Chem. Soc.*, 1862.) The bark also contains a volatile oil and resins. Dr. Stenhouse has obtained from the carpels of *Z. alatum* by distillation an essential oil to which the aromatic properties are chiefly due. This oil, which when pure is called by Dr. Stenhouse *Zanthoxylene*, is a hydrocarbon isomeric with oil of turpentine. It is colourless, refracts light strongly, and has an agreeable aromatic odour; similar to that of Eucalyptus oil; its composition is $C^{10}\ H^{8}$. He also obtained a stearopten, *Zanthoxylin*, floating on the water distilled from the carpels and separable from the crude essential oil. After repeated crystallizations from alcohol, zanthoxylin may be obtained in a state of purity, and then presents the form of large crystals of a fine silky lustre, insoluble in water, but readily soluble in alcohol or ether. It has a very slight odour of stearine, and a slightly aromatic taste. It distils unchanged, its fusing point before and after distillation remaining the same, namely, 80° C., and its solidifying point 78° C. Its composition is $C^{40}\ H^{6}\ O^{4}$. The essential oil was obtained by Pedler and Warden (1888) by distilling the crushed carpels with seeds, in a current of steam. The oil was dehydrated by fused $Ca\ Cl^{2}$. It commenced to boil at 175°—176° C., the greater part passing over between 176°—179° C., the temperature then rose to 181° C. and rapidly to 183° C., when the distillation was stopped. The rectified oil had a specific gravity of ·873 at 15·5 C. Its vapour density determined by Meyer's method was 5·43. They were unable to obtain the crystallizable stearopten isolated by Stenhouse. The freshly distilled oil exposed to 0° C. failed to deposit any crystals. In addition to the essential oil, they also detected the presence of a pale yellow viscid non-drying oil, an acid resin, and a yellow acid principle, forming deep yellow solutions with alkalies and reprecipitated from its alkaline solution by acids.

Several species of Evodia bear capsules very similar to those of Zanthoxylum, notably *E. fraxinifolia.* An oil, supposed to have been yielded by these capsules, was recommended by Helbing (*British Pharm. Confer.*, 1887,) as a deodorant for iodoform; but the fruit of *E. fraxinifolia* does not agree with

Helbing's description, nor does it yield an oil of the nature described by him. The seeds of *E. fraxinifolia* are brown.

TODDALIA ACULEATA, *Pers.*

Fig.—*Rheede, Hort. Mal.* v., 41; *Wight Ill. t.* 66; *Lam. Ill.* ii., 116; *Bentl. and Trim, t.* 49. Espinho do ladrâo (*Port.*), Patte de poule (*Fr.*).

Hab.—Sub-tropical Himalaya, Western Peninsula, Ceylon. The root and fruit.

Vernacular.—Milakaranai (*Tam.*), Konda-kashinda (*Tel.*), Kúdúmiris-wel (*Cing.*), Kánch, Dahan (*Hind.*), Limri (*Mar.*), Kaka-toddali (*Mal.*).

History, Uses, &c.—This scandent shrub appears to have been one of the plants known to Sanskrit writers as Kánchana or golden, on account of the orange colour of its fruit. It was also called Dahana or burning, on account of the pungency of its berries; both of these names are still in use in the vernacular. Rheede says that the unripe fruit and root are rubbed down in oil to make a liniment for rheumatism. Ainslie mentions its use in Southern India. He says:—"Malakarunnay (*Scopolia aculeata, Smith,*) is the Tamool name of a small white root about the third part of an inch in diameter, the bark of which is bitter, pungent and sub-aromatic, and is considered as stomachic and tonic. It is given in a weak infusion to the quantity of half a teacupful in the course of the day; the leaves are also sometimes used for the same purpose." Roxburgh, in the *Flora Indica*, describes the plant fully, and says: "That every part of this shrub has a strong pungent taste; the roots, when fresh cut, particularly so. The fresh leaves are eaten raw for pains in the bowels; the ripe (unripe) berries are fully as pungent as black pepper, and with nearly the same kind of pungency; from these the natives prepare an excellent pickle." The fresh bark is administered by the Telinga physicians for the cure of that

sort of remittent commonly called "hill fever." Flückiger and Hanbury have the following account of the history of Toddaliæ Radix:—"It is from this and other species of Toddalia, or from the allied genus Zanthoxylum, that a drug is derived, which, under the name of Lopez root, had once some celebrity in Europe. This drug was first made known by the Italian physician Redi, who described it in 1671 from specimens obtained by Juan Lopez Pigneiro at the mouth of the river Zambesi, in Eastern Africa, the very locality in which, in our times, *Toddalia lanceolata, Lam.*, has been collected by Dr. Kirk. It was actually introduced into European medicine by Gaubius in 1771 as a remedy for diarrhœa, and acquired so much reputation that it was admitted to the Edinburgh Pharmacopœia of 1792. The root appears to have been sometimes imported from Goa, but its place of growth and botanical origin were entirely unknown, and it was always extremely rare and costly. It has long been obsolete in all countries except Holland, where, until recently, it was to be met with in the shops." In the Pharmacopœia of India it is stated that Toddaliæ Radix is probably a remedy of great value in constitutional debility, and in convalescence after febrile and other exhausting diseases. It is very strongly recommended by Dr. Bidie, of Madras. The French in India use it under the name of *Bois de ronce*.

Description.—The root is woody and in cylindrical flexuose pieces, from ½ to 2 inches in diameter. The bark is about $\frac{1}{12}$th of an inch thick, and consists of a soft, yellow, corky external layer, wrinkled longitudinally, a thin bright yellow layer, and a firm brown middle cortical layer and liber. The wood is hard, yellow, and without taste or smell: its pores are arranged in a concentric manner, and the medullary rays are numerous and narrow. The flowers are white, scented, in simple or compound racemes, and are succeeded by 3 to 5-celled orange-coloured berries as large as a pea, and having a hot peppery taste when unripe. The dry berries are dark brown or nearly black, and have a pungent, aromatic, and very agreeable flavour like citron. When magnified the bark shows

a number of large cells filled with oleo-resin. Some cells contain raphides. The vascular system is loaded with oleo-resin.

Chemical composition.—The bark contains a resin, and an essential oil in flavour recalling oil of citron, also a bitter principle. In the aqueous infusion, tannic acid produces an abundant precipitate of the bitter principle, which probably is of an indifferent nature. Flückiger and Hanbury were unable to detect berberine in the bark. On distillation the leaves yield a pale yellowish green limpid oil, having the odour of citron peel, and a bitter and aromatic taste. The specific gravity at 17° C. is ·873; examined by polarized light in a tube of 200 m. m. it rotates 15°·30′ to the left. The oil has no constant boiling point, but the greater part distils over between 190° and 210°. Metallic sodium has a slight action upon it which causes a yellow colour, and a white deposit in the oil. Sulphuric acid instantly changes it to a rich brown, and nitric acid strikes a transient pink. The oil readily dissolves iodine, and its solution in alcohol is not affected by ferric salts. It absorbs dry hydrochloric acid with considerable rise of temperature and deepening of colour, but no crystals were observed in the mixture after reposing a few days with an excess of the gas.

MURRAYA KŒNIGII, *Spreng.*

Fig.—*Wight Ic., t.* 13; *Roxb. Cor. Pl. II., t.* 112. Curry leaf tree (*Eng.*).

Hab.—Himalaya, Bengal, Western Peninsula, Ceylon.

Vernacular.—Karhi-nimb, Jhirang, Jirani (*Mar.*), Gora-nimb (*Guz.*), Ganda-nim (*Punj.*), Katnim (*Hind.*), Karibevu (*Can.*), Karu-veppilai (*Tam.*), Kari-vepachettu (*Tel.*), Barsunga (*Beng.*).

History, Uses, &c.—This small tree, in Sanskrit Saurabhi-nimba, or fragrant Neem, is found wild in

mountainous districts, and is also much cultivated for the sake of the leaves, which are much used as a condiment. The bark and root have stimulant properties, and are applied externally to parts bitten by venomous animals; the leaves are given raw in dysentery, and are also applied externally to cure eruptions. (*Roxb.*) An infusion of the toasted leaves, according to Ainslie, is used by the Hindus to stop vomiting. The plant is noticed in the Pharmacopœia of India as having tonic and stomachic properties. The leaves are much used as an ingredient in sauces and are sometimes given in decoction with bitters as a febrifuge. Judging by the Marathi names, it must be one of the plants used as condiments and described by Sanskrit writers under the name of Jarana or Jirana.

Description.—The leaves are pinnate with numerous leaflets which are $1\frac{1}{2}$ inch to 2 inches long, alternate, unequally oblique at the base, irregularly ovate, serrated, pubescent, upper surface dark green, dotted, under surface of a lighter colour, venation reticulated, petioles reddish, odour powerful, taste moderately pungent, bitter, and acidulous. The roots spread widely and send up numerous suckers; they have a thick soft bark, the parenchyme of which is loaded with oil globules. It has an agreeable odour and taste like fresh ginger.

The leaves yield to distillation a small quantity of volatile oil resembling that obtained from the leaves of *Ægle Marmelos*.

Chemical composition.—As a considerable quantity, 28 pounds, of the leaves had been previously distilled with water and yielded only a few drops of oil, it was not thought necessary to extract with petroleum ether. A weighed quantity, 80 grams, of the sun-dried and powdered leaves was exhausted with ether, and a measured quantity evaporated, dried and weighed, yielded a greenish-black resin equivalent to $7\frac{1}{2}$ per cent. of the leaves. The bulk of the ethereal extract was allowed to evaporate by exposure to the air, and the residue was instantly mixed with freshly ignited pumice, and extracted

with water. A measured quantity, evaporated, dried and weighed, yielded a small residue equivalent to 3 per cent. of the resin. The aqueous extract was slightly acid to litmus, precipitated by acetate of lead, darkened by iron salts, but not precipitated by gelatine. It reduced Fehling's solution.

The residue from the aqueous extract was dried and exhausted with alcohol, in which it was completely soluble. This alcohol extract allowed to evaporate, yielded a greenish-black resin, of bitter taste, and peculiar odour. It was freely soluble in chloroform, bisulphide of carbon, benzol and amylic alcohol, less soluble in glacial acetic acid and petroleum ether, and almost insoluble in acetic ether. These solutions allowed to evaporate failed to produce anything crystalline, but left the unaltered resin. Treated with sulphuric acid the resin gives an emerald green coloration. It is readily oxidized and attacked by nitric acid, dense red fumes being evolved with considerable frothing, forming a deep red solution, which gives a yellow precipitate on pouring into water, soluble in a larger portion of hot water with yellow solution. The remainder of the acid solution evaporated to dryness, and the yellow residue neutralized with solution of caustic potash, gives a deep red liquid, which is precipitated by sulphate of copper and coloured a deeper red by cyanide of potash. It stained the skin, and dyed silk and flax a yellow colour, the yellow colour of the silk being permanent on washing in water. On heating a portion of the yellow acid residue in a crucible covered with a watch glass, a yellow crystalline sublimate was obtained. These reactions prove the presence of picric acid.

The resin was unaffected by boiling aqueous potash, but dissolved in alcoholic potash. After digesting a day, the potash solution was shaken up with ether; between the ethereal and aqueous solution a layer of fine crystals was observed, but in too small quantity for examination. The ethereal solution evaporated yielded some resin apparently unaltered. A portion of the potash solution poured into water separated some resin as a greenish-yellow powder. Another portion treated with

excess of acid separated the resin apparently unchanged. The dried residue of the ethereal extract was exhausted with absolute alcohol and a measured quantity evaporated, dried and weighed, yielded a residue equivalent to 2½ per cent. of the leaves. The alcoholic extract was completely soluble in water, and gave similar reactions to the aqueous extract of the resin. It was slightly acid to litmus, and of a bitter taste. On acidifying with sulphuric acid and shaking with solvents, chloroform removed a slight residue of a greenish-black colour and uncrystalline. On concentrating the acid solution and setting aside, a few granular crystals separated; these were washed with a little alcohol and recrystallized, forming tufts of acicular crystals. They gave a yellow coloration with caustic potash, but were not coloured by either cold or warm sulphuric acid. They were sparingly soluble in water and alcohol. The aqueous solution was precipitated by tannin and acetate of lead. It slightly reduced Fehling's solution and gave an orange precipitate with a ferroso-ferric salt. It was not precipitated by Mayer's re-agent, nor by bi-iodide of potash. Ferric chloride produced no coloration or precipitate. The mother liquor from the above crystals was allowed to evaporate, and dried up to a bitter black extract. The crystalline principle is probably a glucoside, and might be provisionally named Kœnigin. (*J. G. Prebble.*)

Murraya exotica, *Linn., Wight Ic. t.* 96. China Box, Honey bush (*Eng.*), Buis de Chine (*Fr.*). *Vern.*—Bibsar (*Hind.*), Kámini (*Beng.*), Kounti (*Mar.*), Naga-golugu (*Tel.*), Murchob (*Kumaon*), is a favourite evergreen shrub in gardens, which bears large bunches of sweet-smelling flowers like orange blossom. It has pinnate leaves with coriaceous leaflets, much resembling box leaves in shape, taste and odour. De Vrij has separated a glucoside from the flowers, which he has named *Murrayin*; its composition is $C^{18} H^{22} O^{10}$.

ATALANTIA MONOPHYLLA, *Corr.*

Fig.—*Wight Ic., t.* 1611; *Rheede, Hort. Mal. iv., t.* 12 Wild Lime (*Eng.*)

Hab.—Sylhet, Western Peninsula, Ceylon.

Vernacular.—Matangnár, Mákar-limbu (*Mar.*), Kat-ili-micham (*Tam.*), Adivi-nima (*Tel.*), Katunimbe-gida (*Can.*).

History, Uses, &c.—Rheede says that an oil of the leaves is cephalic, the root antispasmodic, and the juice of the fruit anti-bilious. According to Loureiro, the root is heating, resolvent and stimulant.

Ainslie tells us that a warm, pleasant smelling oil is prepared from the berry of this plant, which in Southern India is considered a valuable external remedy in chronic rheumatism and paralysis. In the Concan the leaf-juice is an ingredient in a compound liniment used in hemiplegia. (*Vanaushadi Prakasha*, 1, 404.)

Description.—*A. monophylla* is a large, thorny, climbing shrub, common on the hills of the W. Peninsula and in Sylhet; the leaves are fragrant like those of the orange; the berry is globular, yellow, about 1 inch in diameter and divided into four cells by membranous septa, one cell is generally abortive; pulp like that of a lime but very scanty; each cell contains one seed ¾ of an inch long and ½ an inch broad, having one convex and two flat surfaces like the segment of an orange; the rind of the fruit has a faint odour of orange peel and abundant oil cells. The oil prepared by the natives is obtained by powdering the seeds, which are very aromatic when fresh, sprinkling them with sweet oil and expressing; the result is a dark green, pleasant smelling oil, which communicates an agreeable warmth to the skin when rubbed on it. The seeds pressed by themselves yield no fatty oil, but the press cloths are moistened with essential oil. A similar preparation is made from the seeds of *Limonia alata, W. & A.*, in the Nilgiris, and a decoction of the leaves of the same plant is applied to cure itch; its Tamil name is Kurunthu.

LIMONIA ACIDISSIMA, *Linn.*

Fig.—*Rheede, Hort. Mal. iv., t.* 14; *Roxb. Cor. Pl., t.* 86.

Hab.—Himalaya, Behar, Assam, W. Peninsula. The fruit.

Varnacular.—Beli (*Hind.*), Tor-elaga (*Tel.*), Nai-bél (*Mar., Can.*).

History, Uses, &c.—Rheede calls it 'Tsjerou-katou-narogam,' and gives 'Limonis da folha cruzado' as the Portuguese name. Regarding its medical properties he says: "Cæterum arboris hujus folia præsentaneum habentur curandæ epilepsiæ remedium. Radix alvum movet, sudores expellit, nec non cruciatibus colicis et cardialgiæ medetur. Fructus siccati stomachum roborant, ac alimentorum in eo fermentationem læsam restituunt; adhæc acri ex variolis, febribusque malignis et pestilentialibus contagiosa potenter resistunt, atque variis venenis præstantissimum censentur antidotum; quamobrem magni æstimantur, et ab Arabibus aliisve mercatoribus avide expetuntur." Graham, Drury and others copy from Rheede, but Drury adds that the fruit is used in Java instead of soap. (*Cf. Rumphius.*) This use of the fruit is known in India, and is indicated by the Marathi name which signifies "barber's Bael fruit."

Description.—*A. acidissima* is a shrub with tripinnate leaves and winged petioles; the root is yellow, bitter and aromatic; the fruit globular, the size of a grape, with yellowish-red rind like that of the lime in structure, and a scanty very acid flesh-coloured pulp with some bitterness and aroma; it is four-celled, but usually contains only three seeds of the colour of orange pips. The fruit is eaten as a stomachic by the hill tribes, but is not seen in the Bombay market. The cultivated *sour lime* in a dried state is often offered in large quantities. It is exported to the Arabian coasts, where it is used as a condiment with fish, meat, &c., being powdered along with the spices commonly used in cooking.

Paramignya monophylla, *Wight, Ill. i., t.* 42, a scandent shrub of the Sikkim Himalaya, Bhutan, Tenasserim, W. Peninsula, and Ceylon, has a reputation as an alterative and diuretic. The root, which is the part used, has a scabrous brown bark and a bitter saline taste; it abounds in large crystals of oxalate of lime. From the resemblance of the fruits to those of *Capparis zeylanica,* the Marathas call it Karuwageti (bitter Wageti). In the Concan the root is given to cattle suffering from bloody urine.

Kakkola.—This is the Sanskrit name of a rutaceous berry, apparently that of **Luvunga scandens,** *Ham.* The berries, as sold in the shops, have a glandular papillose exterior, and a terebinthinate odour and taste; they vary much in size, and contain from one to four dark green, oily seeds with a membranous testa, of the size and shape of orange pips. The berries are used in preparing a perfumed medicinal oil (Kakkolaka), and are sold in the bazaars of Bengal under the name of Kákala; they must not be confounded with Kshirakákkoli, a pseudo-bulb from Nipal, composed of from 8 to 10 ovoid fleshy scales. Kakkola and Kshirakákkoli are chiefly of interest as being the only two constituents of the *Ashtavarga* or 'group of eight medicines' which are known to the modern Hindus. The Sanskrit names of the other six plants are, Rishabha, Jivaka, Meda, Mahameda, Riddhi and Vriddhi.

CITRUS, *Several species.*

Fig.—*Bentley* and *Trim., tt.* 50 *to* 54. Orange (*Eng.*), Oranger (*Fr.*), Lemon (*Eng.*), Citronnier (*Fr.*), Citron (*Eng.*), Cedratier (*Fr.*). The fruit.

Hab.—India, universally cultivated.

Vernacular.—Narangi, Oranges; Limú, Lemons; Turúnj, Mahalung, Citrons (*Hind., Bomb.*). Kich-chilip-pazham, Oranges; Elumich-cham-pazham, Lemons; Nara-dabba, Citrons (*Tam.*). Kich-chili-pandu, Oranges; Pedda-nimma-

pandu, Lemons; Bijapura, Citrons (*Tel.*). Kittale, Oranges; Dodda-nimbe, Lemons; Mada-lada, Citrons (*Can.*).

History, Uses, &c.—Bitter oranges and lemons were introduced into Europe from India by the Arabians, and were used by Avicenna and the early Arabian physicians medicinally. The sweet orange was introduced from China by the Portuguese, who much improved it by cultivation, hence the European name of *Portogallotto* for this orange, and the Indian *Sangtara*, a corruption of Cintra, the name of a mountain valley near Lisbon, where the orange grows in great perfection. The Portuguese appear to have introduced the Cintra variety of orange into India towards the end of the 17th century. According to Dutt (*Hindu Materia Medica*, p. 126,) the different species of Citrus described by Sanskrit writers are as follows:—

Jambira,	*Citrus acida,*	*Roxb.*	*Var.*	3
Limpáka,	*do.*	*do.*		1
Nimbuka,	*do.*	*do.*		2
Vijapura,	*do.*	*do.*		7
Madhukarkatika,	*do.*	*do.*		9
Mahalunga,	*Citrus medica.*			
Karuná,	*do.*	*do.*	*Var.*	
Nagaranga,	*Citrus Aurantium.*			

"The variety of *Citrus acida,* called Jambira, yields the lemon juice used in medicine. Limpáka is much used as a sauce by the natives. The fruits are cut vertically into two pieces, and the fresh juice is sprinkled on soup, dal, curry, &c., to which it imparts a pleasant acid taste and agreeable flavour. A pickle of this fruit in its own juice and salt is a popular and effectual medicine for indigestion brought on by excess in eating, or by indigestible articles of diet. The fruits are first rubbed upon a stone, or their rind scraped a little so as to thin it; they are then steeped in juice obtained from other fruits of the sort, and exposed to the sun for a few days with the addition of common salt; when crisp and of a brown colour, they are preserved in jars. This preparation is called Járak nebu

(digestive lemon) in Bengal. The variety called Nimbuka has larger fruit than Limpáka, and is also used as sauce, like the latter, but is inferior to it in flavour and fragrance. *Citrus Aurantium* is called Kamla nebu in Bengali; the variety grown in the plains has an acid taste, and is called Nárengá. The Sanskrit term Karuná nimbu is variously translated by different authorities. Wilson in his Sanskrit Dictionary calls it *Citrus decumana*. In the Hortus Bengalensis it is translated *Citrus medica*, while Drury and other Madras authorities make it *Citrus limonum*. The Sabdakaldruma does not give any synonym or vernacular term for it, so that it is difficult to say what form is really meant. In the vernacular the term Káruna is applied to a variety of *Citrus medica* (in the Makhzan-el-Adwiya it is given as the Hindi for Naranj), *Citrus decumana* has no Sanskrit name. In the vernacular it is called Batavi nebu, from its having been orignally brought from Batavia. Madhukarkatika is probably the sweet lemon, or possibly the citron. Lemon juice is considered cooling, refrigerant, stomachic and useful in dyspepsia, thirst, fever, &c. Fresh lemon juice is recommended to be taken in the evening, for the relief of dyspepsia with vomiting. It enters into the composition of several carminative medicines, such as the Hingváshtaka, &c. In rheumatic affections, such as pleurodynia, sciatica, lumbago, pain in the hip joints, &c. Sárangadhara recommends the administration of lemon juice with the addition of Yavakshára (impure carbonate of potash) and honey. The root of the variety of *Citrus acida*, called Limpaká, is one of the principal ingredients in a preparation of Iron called Yakridari lauha." The genus Citrus furnishes three out of the five acid fruits (*Phalâmla-panchaka*) of Sanskrit writers, *viz.*, limes, oranges, and citrons; the other two are tamarinds and sorrel. Mahometan writers divide the genus Citrus into Utrunj, citrons; Náranj, oranges; and Limú, lemons; they describe two varieties of Citron—the large, which is broad and obtuse at the base, and the small, both ends of which taper equally; both are yellow and fragrant, but the perfume of the small variety is greatest; the rind of both is bitter; the pulp of the small

bitter, of the large sweet. Citron rind is said to be hot and dry, the pulp cold and dry if acid, but cold and moist if sweet; the seeds, leaves, and flowers hot and dry. The juice is described as refrigerent and astringent, and is said to be digestive and to check bilious vomiting; the rind is tonic and digestive, and is best administered preserved with honey or sugar. The author of the Makhzan-el-Adwiya states that if the rind of a citron be steeped in a vessel of wine it will convert it into vinegar. He also quotes a Mahometan Hadis (tradition), to the effect that Satan will not enter a house in which citrons are kept. The essential oil is extracted by means of sweet oil from the powdered rind, it is considered hot and dry, and is used as a stimulating liniment. The essential oil of the flowers and leaves is extracted in the same way, and is considered to have the same properties. The seeds are generally stated to be alexipharmic. With regard to oranges, the Mahometan writers describe the best kind as large, thin-skinned, and smooth; they say that the rind and flowers are hot and dry, the pulp cold and dry, and recommend the fruit in colds and coughs, when febrile symptoms are present; it is best administered baked with sugar. The juice is valuable in bilious affections, and stops bilious diarrhœa. The orange is the safest of the acid fruits; the peel is useful for checking vomiting, and the prevention of intestinal worms. Orange poultice is recommended in some skin affections, such as psoriasis, &c. Oranges are considered to be alexipharmic and disinfectant; orange water stimulating and refreshing. The essence is extracted by oil from the rind and flowers, and is used as a stimulating liniment. Lemons are stated in the Makhzan-el-Adwiya to be of many kinds; those which are thin-skinned and about the size of a hen's egg are most esteemed; others are described as ovoid and as large as a goose egg. Of all, the juice is the most valuable part; the peel has the same properties as orange peel, but is weaker. The juice is stated to be cold and dry, or, according to some, cold and moist; to be detergent, useful in bilious headaches, and vomiting caused by excess of bile; to purify the blood in scorbutic states of the system; preserved with

sugar or honey lemons are recommended for sore throat, and are considered to act as a detergent; they are administered before purgatives to prepare the body for them, and afterwards to check excessive action. Hakíms pretend to dissolve jewels and pearls in the juice, and also in that of the citron. The seeds are said to be alexipharmic, and the leaves to have the same properties as those of the citron. Sweet limes and crosses with the orange and citron, produced by tying the trees together, are considered inferior in medicinal properties. Gibson tells us that the fruit of *Citrus Bergamia* (the common sour lime of India) eaten daily with salt, is a remedy of the utmost importance in enlargement of the spleen. Dr. Aitkin (*Brit. Med. Journ.*, Oct. 4, 1884, 653,) reports that a decoction of lemons proves to be a very valuable remedy in the treatment of ague. A dose is prepared by cutting a lemon into thin slices, adding three teacupfuls of water, boiling until reduced to one teacupful, and allowing the decoction to stand all night in the open air, when, after being strained, it is ready for administration, and should be given the first thing in the morning. This statement lends interest to an investigation by M. Tanret of some immediate principles in the rind of the bitter orange. (*See Chemical comp.*)

Microscopic structure of Orange and Lemon Peel.—The epidermis exhibits numerous stomata; the parenchyme of the pericarp encloses large oil cells, surrounded by small tabular cells. The inner spongy tissue consists of branched cells separated by intercellular spaces. The outer layers of the parenchyme contain numerous solid yellow bodies, which probably consist of Hesperidin; large crystals of oxalate of calcium are also to be seen, and in the interior tissue vascular bundles.

Chemical composition.—The following estimates of citric acid in East Indian limes has been kindly furnished to us by Mr. G. W. R. Criper, F. C. S., of Calcutta:—

1*st*, *Chholonga*, a large oblong fruit with a rough skin of a reddish-yellow colour (*Citrus medica, Roxb.*). One fruit

contains approximately 100 c. c. juice, = 6·3 per cent. acid calculated as citric.

2nd, China Páti, a round small fruit with a smooth skin of a yellow colour. (*Citrus acida, Roxb.*, var. 1.) One fruit contains 40—50 c. c. juice = 6·5 per cent. acid calculated as citric. 50 of these limes gave 69 fl. oz. juice.

3rd, Kághazi, a small oblong, smooth-skinned fruit, greenish to yellow in colour. (*Citrus acida, Roxb.*, var. 2.) One fruit contains 18—25 c. c. juice = 6·4 per cent. acid, calculated as citric.

4th, Páti, a small round smooth-skinned fruit of a yellow colour. (*Citrus acida, Roxb.*, var. 1.) One fruit contains about 40 c. c. juice = 7 per cent. acid, calculated as citric.

5th, Gora, an oblong rough-skinned fruit of a greenish colour. (*Citrus acida, Roxb.*, var. 3.) One fruit contains about 40—50 c. c. juice = 5·6 per cent. acid, calculated as citric.

6th, Sharbati (Sweet lime), a round smooth-skinned fruit of a pale yellow colour. (*Citrus acida, Roxb.* var. 9.) One fruit contains about 60 c. c. juice = 0·1 per cent. acid, calculated as citric.

The white spongy inner coating of lemons, as well as other fruits of the genus *Citrus*, contains a bitter principle, *Hesperidin*, discovered by Lebreton (*J. Pharm. XIX.*, 377), of which E. Hoffmann obtained 5 to 8 per cent. from unripe bitter oranges. He extracted them with dilute alcohol, after they had previously been exhausted by cold water. The alcohol should contain about 1 per cent. of caustic potash; the liquid on cooling is acidulated with hydrochloric acid, when it yields a yellowish crystalline deposit of hesperidin, which may be obtained colourless and tasteless by recrystallization from boiling alcohol. By dilute sulphuric acid (1 per cent.) hesperidin is broken up as follows:—

$C^{22} H^{26} O^{12}$ =	$C^{16} H^{14} O^{6}$	$C^{6} H^{12} O^{6}$
Hesperidin	Hesperetin	Glucose.

Hesperidin is very little soluble even in boiling water or in ether, but dissolves readily in hot acetic acid, also in alkaline

solutions, the latter then turning soon yellow and reddish. Pure hesperidin, as presented to one of us by Hoffmann, darkens when it is shaken with alcoholic perchloride of iron, and turns dingy blackish brown when gently heated with it. Under the same name Wiedemann has described a principle obtained from unripe oranges differing from ordinary Hesperidin in some respects, especially in being insoluble in alcohol.

Hesperetin forms crystals melting at 223° C., soluble both in alcohol or ether, not in water; they taste sweet. They are split up by potash into phloroglucin and *Hesperetic acid*, $C^{10} H^{10} O^{4}$. On addition of ferric chloride, thin slices of the peel are darkened, owing probably to some derivative of hesperidin or to hesperidin itself. The name hesperidin has also been applied to *yellow* crystals extracted from the Pomelo, *Citrus decumana, Linn.*, the dried flowers of which afford about 2 per cent. of this substance. It is, as shewn in 1879 by E. Hoffmann, quite different from hesperidin as described above; he calls it *Naringin*, and assigns to it the formula $C^{23} H^{26} O^{12} + 4\ OH^{2}$. Naringin is readily soluble in hot water or in alcohol, not in ether or chloroform. Its solutions turn brownish red on addition of ferric chloride. Lemon juice in addition to citric acid contains 3 to 4 per cent. of gum and sugar, and 2·28 per cent. of inorganic salts, of which, according to Stoddart, only a minute proportion is potash. Cossa, on the other hand, who has recently studied the products of the lemon tree with much care, has found that the ash of dried lemon juice contains 54 per cent. of potash, besides 15 per cent. of phosphoric acid. Stoddart has pointed out the remarkable tendency of citric acid to undergo decomposition, and has proved that when lemons are kept for six months the acid rapidly decreases in quantity and finally ceases to exist, having been all split up into glucose and carbonic acid. Lemon juice may with certain precautions be kept unimpaired for months or even years. (*Pharmacographia*, 2nd Ed., p. 116.) To prevent fermentation it should be heated, strained to remove albumen, and stored in well filled bottles. In the

Calcutta market lime juice prepared by native manufacturers, and preserved with a small amount of salicylic acid, is largely sold. Juice containing less than 25 grains of free citric acid per fluid ounce is not passed for Government purposes, and the amount of salicylic acid has been fixed at one-fifth of a grain per fluid ounce. Some experiments were recently made by one of us on concentrating lime juice to one-fourth its original volume in order to facilitate transport. It was found that the loss of acidity in conducting the operation in metallic dishes over a naked flame, and on the water bath at varying temperatures, with constant stirring was 53·2 to 28·8 grains per gallon. The same juice concentrated without heat in vacuo over $H^2\,SO^4$, indicated a loss of only 9·2 grains due to volatile acids. In the experiments in which heat was employed the total loss of acidity, though really partly due to volatile acids, was calculated as citric acid, and to render the results comparable the loss in vacuo over $H^2\,SO^4$ was also calculated as citric acid. On the large scale without using vacuum pans a greater loss occurs. Warnecke found 5·85 per cent. of ash in immature orange fruit, 3·90 per cent. in the pulp of the ripe fruit, and 5·28 per cent. in orange peel when the white inner tissue had been removed. According to Boussingault, orange petals contain 5·00 per cent. of sugar capable of reducing copper solution. Several species of the genus yield an inferior gum resembling cherry-tree gum. By various treatment of an alcoholic extract of the peel, M. Tanret has succeeded in separating—

(*a*) A crystalline acid, insipid and non-volatile, insoluble in water and ether, slightly soluble in cold alcohol, but more soluble in boiling alcohol and chloroform, and having a composition represented by the formula $C^{44}\,H^{28}\,O^{14}$;

(*b*) A crystalline resinous body, extremely bitter, nearly insoluble in cold water, but freely soluble in boiling water and in ether, alcohol and chloroform, and having a composition approximating to that of hesperetic acid;

(*c*) A crystalline glucoside, isomeric with hesperidin, and named isohesperidin.

(*d*) Hesperidin; and (*e*) a glucoside to which the bitterness of the peel is attributed, and which has been named "*aurantiamarin.*" Aurantiamarin is soluble in all proportions in water and in alcohol, but is insoluble in ether and chloroform. It is the natural solvent of hesperidin and the bitter resin (*b*). (*Comptes Rend. cii.,* 518; *Pharm. Journ.* 1886.) The sugar produced when hesperidin and isohesperidin are split up under the action of acids is a mixture of glucose and isodulcite. (*Bull. Soc. Chim.* xlix., 1.)

The rind of the lemon yields the oil of lemon of commerce. The most delicate scented oil is procured by the *sponge process* in use in Italy and Sicily. After soaking in water to which a little soda has been added, the fruit are taken up singly, and firmly pressed against a large and hard-grained sponge. Two or three sharp turns of the wrist causes the sponge to rupture the oil cells in the rind, and the sponge absorbs the exuded oil. The sponge is pressed from time to time, and the expressed liquid allowed to settle, when it separates into three layers, the oil floating on the surface, bright and clear. In Southern France, an instrument called an écuelle is used, which consists of a shallow pan studded on its concavity with strong blunt spikes, and having a receptacle at its lowest part for the oil, and a lip on one side. In using the instrument the fruit is rolled by the hand gently and quickly over the spikes, when the oil separates and collects in the reservoir. Another plan of obtaining the oil is expression. The process of distillation is also used, but the product is inferior. A combined process in which the écuelle and distillation methods are used has been introduced, and it is claimed that while the product is equal in quality to that yielded by mechanical means, the yield is nearly double. One thousand lemons yield from 320 to 400 grams of oil, and about ten gallons of raw juce. Pure oil of lemons contains, according to Bouchardt and Lafont, besides a little cymene, several hydrocarbons, $C^{10} H^{16}$, the most abundant of which is a citrene boiling at about 178° C., and having a rotatory power exceeding + 105,° and yielding a solid optically inactive dihydrochloride.

Oil of limes, derived from the rind of *C. Limetta*, is obtained in a similar manner to oil of lemons, which it somewhat resembles

Orange peel oil, the essence or oil of Portugal of commerce, is also obtained in a similar manner. Wright has isolated from the oil a terpene Hesperidene. (*J. Chem. Soc.*, 1873, p. 549.)

From the flowers of different varieties of the Orange, *oil of Orange flowers* is obtained. Genuine orange flower oil, the *Oleum Neroli* of pharmacy, is obtained by the maceration or absorption process from the flowers of the sweet or bitter orange. By aqueous distillation of the flowers oils are also obtained, but inferior in aroma to that yielded by the first mentioned methods. Thus *C. Aurantium* yields *oil of neroli*, the flowers of *C. bigaradia*, or Seville orange, *néroli bigarade*; while the leaves and young unripe fruit of different varieties of Citrus yield *néroli petit grain*. (Brannt.)

Orange flower water is used in pharmacy, and a tea made from orange flowers is much used in French domestic medicine.

Commerce.—The various species of Citrus are cultivated in most parts of India. The kinds usually met with are: several varieties of Mandarin orange; the common sweet orange; several varieties of sour lime; the sweet lime; the citron; and a fruit which appears to be a cross between the sour lime and orange. Besides these we have the Shaddock or Pummelo in abundance, and occasionally sweet citrons from the Persian Gulf, and sweet oranges from Suez or Zanzibar. Sour limes in a dried state are exported to Arabia, where they are used as a condiment with fish, meat, &c.

ÆGLE MARMELOS, *Corr.*

Fig.—*Bentl. and Trim.*, *t.* 55. Bael tree (*Eng.*), Egle marmel (*Fr.*). The fruit, bark, leaves and root.

Hab.—India.

Vernacular.—Bél (*Hind.*, *Beng.*, *Bomb.*), Vilva-pazham (*Tam.*), Bilva-pandu (*Tel.*), Bilapatri (*Can.*), Bilinu-phal (*Guz.*).

History, Uses, &c.—This is a sacred tree amongst the Hindus, its leaves being used in the worship of Siva. On this account it is to be found cultivated everywhere in Hindu gardens. It is considered sacrilegious to destroy it; enormous quantities of the leaves are gathered for use in the temples at certain seasons. In ancient Sanskrit poems it is frequently alluded to as an emblem of increase and fertility, it is considered to be very auspicious (ati-mangalya). The baton of the Vaisya or third caste of Hindus is obtained from this tree. The fruit is the subject of several Solar-phallic myths. Hindu physicians regard the unripe or half ripe fruit as astringent, digestive, and stomachic, and prescribe it in diarrhœa and dysentery. The ripe fruit is considered aromatic, cooling and laxative. A thick sherbet of the ripe fruit has a reputation among Europeans as an agreeable laxative; the dose is a tumbler-full. The dried pulp of the fruit is called Vilva peshika in Sanskrit. The root bark is used as a remedy in hypochondriasis, melancholia and palpitation of the heart (diseases supposed to be caused by deranged air); it is one of the Dasamula or ten plants (*vide Tribulus terrestris*). The fresh juice of the leaves is given with honey as a laxative and febrifuge; it is used in asthmatic complaints, and with the addition of black pepper in anasarca with costiveness and jaundice; moreover, in external inflammations it is given to correct the supposed derangement of the humours. The Mahometans use the Bel as a medicine, and Muhammad bin Zakarieh describes it; they consider the ripe fruit to be hot and dry, the very young fruit cold in the second degree, and the half ripe fruit cold in the first and dry in the second degree; its properties are described in the Makhzan-el-Adwiya as cardiacal, restorative, tonic and astringent; it is directed to be combined with sugar for administration to prevent its giving rise to piles. The pulp of the half-ripe fruit baked and mixed with sugar and rose water when given on an empty stomach is said to be a good remedy for diarrhœa. Garcia d'Orta, physician to the Viceroy of Goa in the 16th century, describes the Bel fruit under the name of Marmelos de

Benguala, and mentions its use in dysentery. Bontius also mentions it. Rheede in his *Hort. Malab.* (Vol. iii., p. 37,) notices its use on the Malabar Coast. Rumphius remarks that the gum is like cherry gum, it tastes at first sweet but afterwards slightly acrid. He also tells us that the Chinese make an extract of the leaves and young fruit which they use for adulterating opium. Ainslie and the author of the Bengal Dispensatory quote Rheede, but give no further information upon the use of the fruit in dysentery. In 1853, Sir B. Martin, writing in the *Lancet* (Vol. II., p. 53,) called the attention of the profession to it; finally, in 1869, it was made official in the Pharmacopœia of India, where it is recommended as a remedy of much value in atonic diarrhœa and dysentery and in the advanced stages of those diseases, in irregularity of the bowels, and in habitual constipation. In the Concan the small unripe fruit (Bál belphal) is given with fennel seeds and ginger in decoction for piles; a compound pill containing two parts each of Bál belphal, *Mimusops elengi* fruit, and galls, one part each of nutmegs, cloves, saffron, nágkesar and mace, is used as a remedy for diarrhœa; the dose is one pill for a child and three for an adult. Two tolás of the juice of the bark is given with a little cummin in milk as a remedy for poverty of the seminal fluid. The best preparation of Bael fruit is a marmelade made from the full grown but still tender fruit cut in thin slices; it keeps well, which is not the case with the conserve made from the pulp of the ripe fruit usually met with in the shops.

Description.—The fruit is a large berry, 2—4 inches in diameter, variable in shape, being spherical or somewhat flattened like an orange, ovoid, or pyriform, having a smooth hard shell; the interior divided into 10—15 cells, each containing from 6—10 woolly seeds, consists of a mucilaginous pulp, which is very aromatic, each seed is surrounded by a clear tenacious mucus. The commercial article is entire or in dried slices, having on the outer side a smooth greyish brown shell, enclosing a hard orange brown gummy pulp, in which the

cells and seeds may be seen; the latter are oblong and compressed, about 3 lines long, and covered with whitish hairs; the dried pulp has a mucilaginous, acid, and slightly astringent taste, and a very agreeable aroma, resembling that of elemi.

Microscopic structure.—The rind is covered with a grey cuticle or bloom, and further shows two layers, the one exhibiting not very numerous oil cells, and the other and inner made up of sclerenchyme. The tissue of the pulp consists of large cells. In the epidermis of the seeds certain groups of cells are excessively lengthened and constitute the woolly hairs already noticed.

Chemical composition.—As stated in the *Pharmacographia*, the dry pulp moistened with cold water yields a red liquid containing chiefly mucilage and (probably) pectin, which separates if the liquid is concentrated by evaporation. The mucilage may be precipitated by neutral acetate of lead or by alcohol, but is not coloured by iodine. It may be separated by a filter into a portion truly soluble (as proved by the addition of alcohol or acetate of lead) and another, comprehending the larger bulk, which is only swollen like Tragacanth, but is far more glutinous and completely transparent. Neither a per nor a proto salt of iron shows the infusion to contain any appreciable quantity of tannin. Warden remarks that the ripe and unripe fruit, when moistened with a solution of ferric chloride gives a marked tannic acid reaction, strongest in those portions of the pulp next the rind, the clear mucilage surrounding the seeds he found to have an acid reaction, to contain lime and to afford no tannin reaction. Warnecke found 2·08 per cent. of ash in Bael fruit, and 3·72 per cent. in the pulp separated from the rind. The wood has the following percentage composition:—

Soluble potassium and sodium compounds.........	·16
Phosphates of calcium and iron	·13
Calcium carbonate	2·16
Magnesium carbonate	·19
Silica with sand and other impurities	·01

—(*Warth., Indian Forester X.*, p. 63.)

28 lbs of the fresh leaves submitted to distillation in the usual manner, rapidly yielded one ounce of a thin mobile oil of a faint yellowish-green colour and neutral reaction, which had a peculiar aromatic odour and slightly bitter taste. It had a specific gravity of 0·835 at 32° C. and a boiling point of 175° C. Examined with the polariscope it turned a ray of polarized light to the left $(a)_D = -22{\cdot}87$. The oil was miscible with carbon bisulphide in all proportions, readily soluble in alcohol, and one part in three of 84 per cent. alcohol. It gave a reddish-brown colour with sulphuric acid, a deep brown with sulphuric acid and potassium bichromate, a reddish coloration with fuming nitric acid. It dissolved picric acid when slightly warmed, and the solution had a deep orange colour; on cooling crystals were deposited. With a solution of bromine in chloroform it formed a colourless solution. Dissolved in carbon bisulphide, and nitric acid 1·2 added, the upper layer of bisulphide showed a greenish colour and the lower of acid a red colour. The oil dissolved iodine with explosive action, and was soluble in glacial acetic acid. (*H. R. Hoyles.*)

Commerce.—Value, dry fruit, ¾ to Re. 1 per 100; green fruit 6 as. per 100; dry pulp, Rs. 20 per cwt. The Bombay market is chiefly supplied from the Deccan. The fruits are usually small and not suitable for the preparation of the conserve; for this purpose the large cultivated fruit of Bengal should be obtained in a fresh condition. Season—November and December.

FERONIA ELEPHANTUM, *Corr.*

Fig.—*Roxb. Cor. Pl., t.* 141; *Wight Ic., t.* 15. Wood Apple (*Eng.*), Pommier d' éléphant (*Fr.*).

Hab.—India. The leaves, fruit and gum.

Vernacular.—Kowit, Kavitha (*Hind., Mar.*), Kathbel (*Beng.*), Nila-vilam (*Tam.*), Kotha (*Guz.*), Byalada (*Can.*), Nela-velaga (*Tel.*).

History, Uses, &c.—The Wood apple, or Elephant apple, so called because the fruit is like an elephant's skin, in Sanskrit Kapittha (on which monkeys dwell) and Kapipriya (dear to monkeys), is met with throughout India, and is cultivated for the sake of the fruit, which is edible. The Hindus consider the unripe fruit to be a useful astringent in diarrhœa and dysentery, and prescribe the ripe fruit in affections of the gums and throat. It is called Dadhiphala in Sanskrit, as its taste is compared with that of Dadhi or coagulated milk. The leaves are aromatic and carminative. The author of the Makhzan-el-Adwiya says that the leaves are very astringent, and have the taste and odour of Tarragon. He describes the fruit as cold and dry in the second degree, refreshing, astringent, cardiacal and tonic, a useful remedy in salivation and sore throat, strengthening the gums and acting as an astringent; sherbet made from the fruit increases the appetite, and has alexipharmic properties. The pulp applied externally is a remedy for the bites of venomous insects; if not obtainable, the powdered rind may be used Ainslie mentions the use of the fruit, leaves, and gum. He says that the latter supplies the place of gum Arabic in Lower India, and is prescribed by Tamool practitioners to relieve tenesmus in bowel affections. The *Feronia elephantum* is the Balong of the Portuguese. It is mentioned in the Bengal Dispensatory and Pharmacopœia of India, but no further information as to its properties is to be gathered from these works. The fruit when cultivated, attains a diameter of four inches. The gum forms part of the country gum which is sold in the bazárs. It is the Dadhitthara-rasa of Sanskrit writers. Under the name of Pancha-kápittha, or five products of the Feronia, the Hindus prepare a medicine which contains the flowers, bark, root, leaves and fruit of the tree. The country people pound the leaves with curds and apply the mixture to the whole body as a remedy for heat of blood supposed to be caused by bile.

Description.—The ordinary wood apple is globose, one-celled, about $2\frac{1}{2}$ inches in diameter, covered with a scurfy

epidermis, which is of a light grey or dirty white colour; beneath the epidermis, the rind is dull green, woody and granular, much more fragile than that of the Bél. The odour when ripe is aromatic, and resembles that of melon. There are about 500 seeds in each fruit of a bland taste and free from bitterness; they are embedded in a pale greyish-pink pulp, and are of an oblong compressed form, with thick fleshy cotyledons, and a radicle pointing away from the hilum. The leaves have from 5—7 leaflets, cuneate, or obovate with a crenate tip; they smell aromatic. The root bark is thick, white and starchy; it has the odour of the leaves and contains essential oil. The gum is in tears or irregular masses, yellow or brownish; dissolved in water it forms an almost tasteless mucilage, much more viscid than that of gum Arabic made in the same proportions. The solution reddens litmus, and is precipitated by alcohol, oxalate of ammonia, alkaline silicates, perchloride of iron, but not by borax. Moreover, the solution is precipitated by neutral acetate of lead or caustic baryta, but not by potash. If the solution is completely precipitated by neutral acetate of lead, the residual liquid will be found to contain a small quantity of a different gum, identical apparently with gum Arabic, inasmuch as it is not thrown down by acetate of lead. If the lime is precipitated from the Feronia mucilage by oxalate of potassium, the gum partially loses its solubility and forms a turbid liquid.

Chemical composition.—The larger portion of Feronia gum is not identical with gum Arabic; when examined in a column of 50 mm. length, it deviates the ray of polarised light $0^{\circ}\cdot 4$ to the right,—not to the left, as gum Arabic. Gum Arabic may be combined with oxide of lead; the compound (arabate of lead) contains 30·6 per cent. of oxide of lead, whereas the plumbic compound of Feronia gum dried at 110° C. yields only 14·76 per cent. of Pb O. The formula $2\,(C^{12}\,H^{21}\,O^{11})\,2\,Pb + 2\,(C^{12}\,H^{22}\,O^{11})$ supposes 14·2 per cent. of oxide of lead. Feronia gum repeatedly treated with fuming nitric acid, produces abundant crystals of mucic acid. Dried at 110° C. it

yields about 17 per cent. of water. The ash amounts to about 3·55 per cent. (*Pharmacographia, p.* 212.)

The pulp of the fruit contains citric acid and mucilage. If the pulp is thoroughly dried in a water bath, and then covered with water for about five minutes, an almost pure solution of citric acid is obtained and recognised by the usual reagents; if left in contact with water for a longer period, the gum begins to enter into solution. The dried pulp contains 15 per cent. of citric acid, and a small quantity of deliquescent ash consisting of potassium, calcium and iron salts.

The leaves yield to distillation a small quantity of essential oil similar to that obtained from Bael leaves. (*See Ægle Marmelos.*)

Commerce.—The gum, or rather the mixed gums of which Feronia gum forms a part, is known as Ghati gum. In London these mixed gums are known as Amrads, and the term Ghati is applied to the gum of *Conocarpus latifolia.* The term Amrad is unknown in India, and appears to be of African origin, and to be applied to coloured Acacia gums.

SIMARUBEÆ.

BALANITES ROXBURGHII, *Planch.*

Fig.—*Wight Ic., t.* 274. Egyptian myrobalan (*Eng.*), Balanite Agihalad (*Fr.*).

Hab.—Drier parts of India, Egypt. The fruit.

Vernacular.—Hingan, Ingua, Hingol (*Hind.*), Hingon (*Beng.*); Nanjundan (*Tam.*), Gári, Ringri (*Tel.*), Hingana (*Mar.*), Hingoria (*Guz.*).

History, Uses, &c.—This plant is sacred to Isis, who is represented with a crown of it in her hand. In Egypt it was also a symbol of farewell and hope given to dying people. The seeds are found along with other fruit seeds in the Egyptian tombs. The Greeks appear to have become acquainted

with the tree through the Egyptians, and it is mentioned by Hippocrates, Theophrastus, Strabo and Dioscorides under the name of Persea—περσέα. Dioscorides says that the dried leaves are applied to blood eruptions, and that the fruit is often infested by an insect celled κρανοκόλαπτον. Latin writers also notice the tree being sacred to Isis, and Pliny (15, 13,) says that Alexander gave orders that the victors should be crowned with it in the games which he instituted in honour of Perseus at Memphis. The fruit appears to have been occasionally confounded by the ancients with the Persica or peach, as it is sometimes described as edible. Baillon says that in Egypt the ripe fruit is called "desert date" and the unripe "Egyptian myrobalan." The African Arabs call the tree *El Heylyg*, and use the pulp as a detergent, and the bark to poison fish. In Senegambia the leaves are used as a vermifuge, and the roots and fruit as a purgative. (*Corre et Lejanne.*) In India Balanites is the Ingudi or Ingua of Sanskrit writers, who also call it Tápasa-taru and Munipádapa, "anchorite's tree," because the Gurus prepare from the seeds an oil for the lamp which they use in the ceremony of *Guru-upásana*, or initiation of a Hindu by his spiritual guide. Another name for the fruit is Gauri-tvac, which seems to connect it with the worship of Gauri or Isani, the Indian goddess of abundance, the earth, the *sakti* or power of Isvara or Mahadeva, in whose honour bombs made with the shell are exploded. The festival of this goddess, called *Kátyayanivrat*, is conducted by women at the vernal equinox; an interesting description of it under the name of the Gangore festival will be found in Tod's *Rajasthan* (Vol. I., p. 570). In all parts of India a boat is used as described by Herodotus in the Isis worship at Busiris, and by Tacitus in the Ertha worship among the Suevi in Germany. At the Ganpati festival in India, Gauri is worshipped in the form of a cornucopœia-shaped bouquet of leaves and flowers, and a similar emblem appertained to the Demeter or Ceres of the Greeks. Gauri also holds in her hand a Lotus flower as emblematic of reproduction. The leaves of Balanites are the Hingupatri of modern Sanskrit writers, but the true Hingu-

patri was doubtless the Asafœtida leaf. In the Concan and in other parts of India where this tree is unknown, the oil for the Guru-upásana ceremony is obtained from *Terminalia Catappa*, a tree which is not a native of any part of India except perhaps the eastern borders of Bengal.

The unripe fruit of Balanites is found in the druggist's shops in many parts of India, and is used as a purgative and anthelmintic, the dose being half of the pulp of a single fruit; in smaller doses of from 2—20 grains it is expectorant. The bark, unripe fruit, and leaves are given to cattle as an anthelmintic. The physiological action of the bark and fruit is similar to that of the genus Polygala, and a few drops of a tincture of the fruit is as efficient an emulsifier as Tincture of Senega. The kernel yields a bland fatty yellow tasteless oil, which is applied to burns and sores.

Description.—The fruit is an ovoid drupe, about two inches long, by 1½ inch broad, having a nearly smooth, fragile epicarp, marked by ten shallow longitudinal grooves; the greenish soapy mesocarp is traversed by numerous bundles of vascular fibres, and is adherent to the pentagonal, thick, woody shell. The descending seed contains under its coats a thick ex-albuminous embryo, with plano-convex cotyledons sometimes unequal, bilobed or corrugate, and a short superior radicle. As found in the shops, the fruit presents a wrinkled appearance, and is of a greenish-yellow colour, having been gathered a little before maturity.

Chemical composition.—The bark yields a principle similar to, if not identical with saponin. (*See* Saponaria.) The oil (*Zachun oil* of Africa) has a sp. gr. of ·9185 at 15·5° C., and congeals at zero. It yields 94·4 per cent. of crystallized fatty acids melting at 31°, and with a mean combining weight of 277. Sulphuric acid produces a brown colour not altered by stirring. With Massie's nitric acid test the oil becomes opaque, and is only slightly darkened in tint; the lower part of the oil becomes white and solid with a green ring where it touches the acid. Heated with a third of its weight of nitric acid, it changes.

to a light orange liquid, and when left to cool becomes solid in a few hours. It is a slow drying oil, and is readily bleached in sunlight. There are some points of resemblance between it and that of *Arachis hypogœa.* The seeds yield to solvents a little more than 50 per cent.

The pulp of the fruit contains organic acids 1·8 per cent., saponin 1·32 per cent., besides mucilage and sugar.

PICRASMA QUASSIOIDES, *Benn.*

Hab.—Sub-tropical Himalaya, South China. The wood and bark.

Vernacular.—Kashshing (*Hind.*).

History, Uses, &c.—A small tree or large bush with unequally pinnate leaves, and the aspect and foliage of Ailantus; it bears axillary stalked cymes of small diœcious or polygamous flowers, which have the calyx four or five parted. The fruit is a pea-like red drupe and is edible. Royle first drew attention to the bark and wood as being quite as bitter as quassia, and Stewart states that the leaves are used in the Punjab to cure scabies and the wood to kill insects. The bark has been recommended by Macardieu as a febrifuge, and under the name of *Brucea* (*Nima*) *quassioides,* the plant is noticed as a likely substitute for quassia in the Indian Pharmacopœia. In this work the bark is said to be sold under the name of *Bharangi* in Bengal, but this we are unable to confirm, as several samples of bharangi which we have obtained in Bengal and elsewhere all proved to be the roots and stems of *Clerodendron serratum.*

Description.—The wood consists of pieces of the larger branches from 3 to 6 inches in diameter, and is covered with a dark-brown bark, which has a somewhat netted surface, and is marked by transverse scars. On rubbing off the outer layer of suber an olive-green surface is exposed. The bark from a stem of 3 inches in diameter was ⅛ inch thick and very

compact. The wood and bark are of a light yellow colour; in the former a transverse section shows numerous fine, close, medullary rays, which intersect well marked, irregular, concentric rings. The centre of the stem is occupied by a cylinder of pith—in short, in appearance and taste the drug bears a close resemblance to quassia.

Under the microscope a transverse section of the bark exhibits an outer layer of brown suber, within which are two or three rows of empty transparent cells, followed by 8 to 10 rows of cells containing chlorophyll; these are succeeded by the liber tissue, which is divided into layers by about six rows of yellow stone cells. Lastly comes the cambium layer.

The medullary rays consist of about 15 vertical layers of cells; the single layers contain from one to five rows of cells. The tissue of the bark contains resinous deposits and crystals of oxalate of lime, which are so numerous towards the exterior portion that they produce opaque patches, visible to the naked eye.

The wood so closely agrees with the microscopic description of quassia by Pocklington (*Pharm. Jn.* (3) *V.*, 321, *Year-Book,* 1875, p. 190), that we think it unnecessary to reproduce the particulars.

Chemical examination.—Our experiments indicate that the wood contains a crystallizable principle, probably quassiin, a fluorescing, bitter, resin-like principle, and at least one other non-crystallizable, bitter, resinous body, probably the uncrystallizable quassiin of Adrin and Mordeaux. There are several points of interest connected with the examination of *P. quassioides* to which we would refer. Firstly, the wood is not so bitter to the taste as ordinary quassia wood. Secondly, the authors of the *Pharmacographia* state that they obtained 7·8 per cent. of ash from quassia wood dried at 100° C.; the ash of *P. quassioides* obtained by us amounted to only 1·7 per cent. Thirdly, a watery solution of ordinary quassia wood is stated to display a slight fluorescence, especially if a little caustic lime has been added. According to Flückiger and

Hanbury this is apparently due to quassiin. We have repeated the experiment with a sample of ordinary quassia wood with negative results. The *P. quassioides* wood when treated with water or alcohol affords solutions which display a very marked greenish fluorescence. Regarding the content of quassiin it appears to vary considerably. A. Christensen (*Archiv. der Pharm.* (3) XX., 481,) states that he found the amount to vary greatly, some specimens yielding scarcely any. Stillé and Maisch give the yield at 0·15 to 0·05 per cent. (*National Dispensatory.*) The authors of the *Pharmacographia* at about 0·1 per cent. MM. Adrin and Mordeaux—(*Repert. der Pharm.* XI., 246—50) obtained 0·125 to 0·15 per cent. of white crystalline quassiin. Oliveri and Denars (*Gazetta Chim. Ital.* XIX., 1—9) obtained only 0·03 percent. of the pure principle. While Goldschmiedt and Weidel in 1877 failed to isolate quassiin, they obtained however a yellow resin, the presence of which had been previously noticed in the wood by Flückiger and Hanbury. The amount of crystallizable principle present in the wood we examined, we are unable to accurately give; as a rough approximation we do not consider that it would amount to more than ·02 to ·03 per cent. as an outside limit.

Regarding the methods of analysis, extraction of the wood by alcohol, and subsequent boiling of the dry alcoholic extract with water, concentrating, and precipitating with tannin, appears to give the best results, as far as a crystalline product is concerned.

In order to ascertain whether any of the Jaborandi alkaloids were present in the wood or not, we made the following experiments:—An alcoholic extract of the wood was digested with water acidulated with one per cent. hydrochloric acid, the solution filtered from insoluble resinous matter, and evaporated to a small bulk. When cold the deep yellow solution was precipitated with phosphomolybdic acid, filtered, and the precipitate washed with water containing a trace of hydrochloric acid. The precipitate was then treated with

baryta water, the excess of barium removed by CO^2, and the liquid with precipitate evaporated to dryness. The residue was then boiled with 96 per cent. alcohol. On evaporating off the alcohol a yellow non-crystalline varnish-like residue was left. This residue was bitter, partly soluble in water, and responded to the usual alkaloidal re-agents. The amount obtained did not exceed a trace.

The method of extraction above described was subsequently modified in the following manner:—

An alcoholic extract obtained from 263 grams of the wood was digested at a gentle heat for some hours with water acidulated with 2 per cent. of hydrochloric acid. The deep yellow solution was filtered, rendered alkaline with ammonia, and agitated with chloroform. The separated chloroform was then agitated with dilute hydrochloric acid, the acid liquid decanted, made alkaline with ammonia, and again agitated with chloroform; and this operation was repeated a second time. Finally the chloroform was evaporated off, and left an amber-coloured non-crystalline, transparent varnish-like residue. In water this extract was only slightly soluble, but in water acidulated with a few drops of nitric acid, it was wholly soluble, with the exception of a few flakes. On spontaneous evaporation of the nitric acid solution a yellowish non-crystalline residue was obtained, not easily soluble in cold 96 per cent. alcohol, slightly soluble in cold water, and not wholly soluble in warm water. An aqueous solution was of a deep yellow colour and possessed the following properties: Taste distinctly pungent, very slightly bitter and acrid. With alkaloidal group re-agents very marked precipitates were obtained; with very dilute solution, however, phosphomolybdic acid was one of the few re-agents which afforded a reaction. Fröhde's re-agent gave no colour reaction in the cold or on heating. The physiological action of the principle was tried by the following experiments:—A solution containing ·0009 gram of the principle injected hypodermically below the skin of a frog produced no symptoms; a solution containing about ·002 of a

gram hypodermically injected below the skin of a cat's thigh yielded negative results; one of us swallowed a solution containing ·0036 of a gram without any symptoms whatever ensuing. A strong solution applied to a cat's eye caused no contraction of the pupil.

The amount of this principle separated from the wood, though we had operated on a fairly large amount, was insufficient for further experiments. Our experiments indicate however the presence of a distinctly alkaloidal principle in the wood, in addition to the principles already referred to. As far as our experiments have gone there is no evidence to show that the alkaloidal principle is related to the Jaborandi alkaloids. We have also examined *P. nepalensis* for these alkaloids with a negative result. It however contains an alkaloid which does not appear to be identical with that found in *P. quassioides*.

AILANTUS EXCELSA, *Roxb.*

Fig.—*Roxb. Cor. Pl., t.* 23; *Wight, Ill. I., t.* 67.

Hab.—Behar, W. Peninsula. The bark and leaves.

Vernacular.—Maharukh, Mahanimb, Arna (*Hind.*), Maharukh (*Mar.*), Peru-maram (*Tam.*), Pedda-mánu (*Tel.*), Doddamari (*Can.*), Motho-araduso (*Guz.*).

History, Uses, &c.—It appears probable that this is one of the trees to which Sanskrit writers have given the name of Mahanimba. Its bark and leaves are in great repute as a tonic in Southern India, especially in debility after childbirth. The juice of the leaves is usually administered in *khir* (a kind of rice milk), or the juice of the fresh bark is given with cocoanut milk and treacle, or with aromatics and honey; it is said to stop after-pains. Ainslie says that the bark has a pleasant and somewhat aromatic taste, and is prescribed by native practitioners in infusion in dyspeptic complaints to the extent of three ounces twice daily, but from his description of the bark, it appears probable that he refers to *A. malabarica*, which bears the same Tamil name, the bark of *A. excelsa* being

intensely bitter like Quassia. Dr. Wight mentions that in the Circars the bark is regarded as a powerful febrifuge, and as a tonic in cases of debility.

Description.—Bark light coloured, very thick and granular, externally hoary, rough from the presence of numerous longitudinal scabrous ridges; internal surface yellowish white and finely fibrous; when soaked in water it swells greatly, and becomes glutinous on the surface; odour when moist acrid and disagreeable; taste very bitter. The leaves are abruptly pinnated, tomentose when young, afterwards glabrous, leaflets 10—14 pair, 4—5 inches long, coarsely toothed at the base; taste bitter and somewhat aromatic

Microscopic structure.—Sections for the miscroscope show that a great portion of the bark consists of large stony cells collected together in groups. There also many conglomerate raphides.

Chemical composition.—Dr. N. Dáji has separated from the bark an acid principle which he has named *ailantic acid.* It is reddish-brown, very bitter, and forms a deliquescent mass of waxy consistence, very easily soluble in water, less so in alcohol and ether, and insoluble in chloroform and benzol. (*Pharm. Jn.* (3) I., 154.)

AILANTUS MALABARICA, *DC.*

Fig.—*Rheede Hort. Mal. vi., t.* 15.

Hab.—Western Peninsula, Ceylon.

Vernacular.—Ood (*Mar.*), Peru-maram (*Tam.*), Pedda-manu (*Tel.*), Hem-mara (*Can.*).

History, Uses, &c.—This tree grows along the edge of the Ghauts on the Western Coast. It is the Pongelion of Rheede, who gives Sarala* as the Brahminic name. The resin is known as Baga-dhup in Canara, and in Travancore as

* शरल is the Sanskrit name for *Pinus longifolia.* The resin of *A. malabarica* appears to be regarded as a substitute for Pine resin in Southern India.

Matti-pal. The bark has a pleasant, astringent and slightly bitter taste, is given in cases of dyspepsia and dysentery, and is also considered a valuable tonic and febrifuge. Reduced to powder, mixed with milk and strained, the resin is given in small doses in dysentery and also in bronchitis, and is reputed to be an excellent remedy, chiefly owing to its balsamic properties. The fruit, triturated with mango, and mixed with rice, is reckoned useful in cases of ophthalmia, and the juice of the fresh bark in 1 oz. doses with an equal quantity of curds is said to be a valuable remedy in dysentery.

Description.—The resin attached to the bark which was collected for us in Canara was very nearly the colour of hock-bottle glass; it was hard, brittle and translucent, and mixed with portions of the corky outer bark of the tree; alcohol readily dissolved it, and on evaporation left it as a very viscous, transparent, light-brown semi-liquid, which did not solidify after many days' exposure to a steam heat; when burnt it gives out a fragrance; the perfume is, however, inferior to that of many other resins employed as incense. The fruit is purplish-brown, of the size of a large nutmeg, slightly 3-angled at the base, mucronate at the apex; it consists of a very thick woody nut, surrounded by an oily shrivelled pulp; within are three cells, each of which contains a sweet-tasted oily flat seed.

Commerce.—The resin as met with in commerce is dark brown or grey in colour, plastic and opaque. It appears to have been obtained by tapping the trees, and is usually very impure. Value, Rs. 24 per cwt.

SAMADERA INDICA, *Gärtn.*

Fig.—*Gärtn. Fruct. II., t.* 156; *Wight, Ill., t.* 68; *Rheede, Hort. Mal. vi., t.* 18.

Hab.—Western Peninsula, Ceylon. The bark.

Vernacular.—Niopa (*Tam.*), Karinghota (*Malabar*), Samadara (*Cing.*).

Description, Uses, &c.—A tree 30 to 35 feet high, the Karin Njoti of Rheede, who gives Lokhandi as the Brahminic name: It has large, alternate, oblong leaves, and long axillary or terminal peduncles, divided at the top into a small umbel, which becomes pendulous in fruit; the latter is oval, 1½ by 1 inch, and is a dry, compressed, one-seeded drupe, with a narrow unilateral wing; its surface is coriaceous, smooth, or slightly reticulated, and of a brown colour. The seed is brown and curved. The bark (Niepa bark) and the seeds are very bitter; the former is used as a febrifuge on the Malabar Coast. The wood is bitter, of a pale yellow colour like quassia wood, and is prescribed with myrobalans in fever. Sandals made from the wood are supposed to keep off malaria and other diseases, probably from the fact of their protecting the feet and keeping them dry. The natives also extract an oil from the kernels, which is said to be a good application in rheumatism. The bruised leaves are externally applied in erysipelas, and the seeds are worn round the neck as a preventive of asthma and chest affections. (*Rheede.*) This drug may well be used as a substitute for quassia.

The bark from the smaller branches occurs in quills from half an inch to one inch in diameter, its external surface is minutely fissured in every direction, of a dark brown colour, with light coloured patches here and there caused by exfoliation of the suber. Beneath the suber, which can be easily separated, the bark is yellowish-white, and this colour extends through its substance to the inner surface. The bark has a short fibrous fracture and bitter taste like quassia. A transverse section magnified presents no peculiarity worthy of remark.

Chemical composition.—De Vrij (1872) expressed from the seeds 33 per cent. of a light-yellow bitter oil, which contains, according to Oudemans, 84 per cent. of olein and 16 per cent. of palmitin and stearin. The bitter principle, *samaderin*, was yellowish, and soluble in water and alcohol and amorphous; Tonningen (1858) had obtained it from the seed and bark in

white scales, which became yellow with nitric or hydrochloric acid, and violet red with sulphuric acid. Flückiger calls it *quassiin.* (*See Year-Book Pharm.*, 1886, p. 196.)

BURSERACEÆ.

BOSWELLIA.

Several species inhabiting Eastern Africa, near Cape Guardafui, Socotra and the Southern Coast of Arabia.

Fig.—*Bentl. and Trim.*, *t.* 58. Frankincense trees (*Eng.*), Arbres d'encens (*Fr.*).

Hab.—Arabia, Socotra, Africa. The gum resin. Olibanum.

Vernacular.—Olibanum, Kundur, Lubán (*Arab.*, *Hind.*), Visesh, Esesh (*Bomb.*), Parangi-shambirani (*Tam.*, *Tel.*).

History, Uses, &c.—For an account of the different species, Birdwood on the Genus Boswellia, with descriptions and figures of three new species [*Linn. Trans.* xxvii. (1871), 111,] and Balfour (*Trans. Roy. Soc. Edin.* Vol. xxxi.,) may be consulted; also the *Pharmacographia*; but the exact number of species cannot be determined until more perfect materials shall have been obtained. An interesting summary of the history of Olibanum in Europe will be found in the *Pharmacographia*. It is the θύος, λιβάνωτός and ὀλιβανος of the Greeks and the Tus or Thus of the Romans.* The olibanum trade between Arabia and India probably dates from pre-historic times. In the Book of Genesis (B. C. 1700), Arab merchants are mentioned as bringing spices, resin and stacte upon their camels from Gilead to Egypt; as no spices are produced in Arabia these must have come from India across the

* Confer. Theoph. Hist. Plant. iv., 6. ix. 1, 2, 4. Dios. i., 72. Plin. 12. 30, 31, 32. Lucr. 3. 328. From Pliny's account it appears that there was no female frankincense in his time.

Persian Gulf. Alexander, B. C. 325, found a vessel loaded with frankincense at the mouth of the Indus, and trading companies are mentioned in Yajnavalkya's Code, B. C. 300. The chief centres of trade on the Western Coast were Sopara, Sanjań, Chaul (Perimula), and Thana, where markets appear to have been held during the fair season for the sale of Indian and Chinese merchandise in exchange for that of the West. Trade suffered from the opposition of the Persians and Brahmins in the 6th century B. C., but recovered in the 2nd century B. C., when its course was still from Egypt to Berenike and Aden, round the Arabian Coast to Kurrachi, and *via* Broach to the Thana ports. On the Roman conquest of Egypt, B. C. 30, trade greatly increased by the same route, until in A. D. 47 Hippalus discovered the monsoons and the possibility of crossing direct to the Indian Coast. In Pliny's time the principal exports from India were sesamum, oil, sugar, spices, rice, nard, costus, pepper, lac and indigo, and the imports frankincense, gum, storax, and Yavan girls. (*Sakuntala.*) In A. D. 525, cloves and aloe and sandalwood came from Ceylon, which had then become the chief centre of trade in the East The trade between India and Egypt began to fall off about the close of the 3rd century, and by the 6th century it had almost entirely been transferred to the East African ports. Thana and its ports were still important marts from the 9th to the 13th century, as we learn from the accounts of El Biruni, Ibn Haukal and other Arabian travellers. (*Bombay Gazetteer*) Sanskrit writers speak of olibanum as Kundurú, and describe its use as an incense and as a local application to indolent swellings to promote suppuration. The Mahometan writers describe several kinds of Olibanum—1*st*, deep yellow tears, called Kundur Zakar, or Male Frankincense; 2*nd*, pale tears, called Kundur Unsa, or Female Frankincense; 3*rd*, Kundur Madahraj, artificial tears, made by shaking the moist exudation in a basket; 4*th*, Kishar Kundur or Kashfa, the bark or scurf of the tree coated with the exudation (*Dhup of Bombay market*); 5*th*, Dukak Kundur, or dust of Olibanum. The first kind is most esteemed. Mir Mohammad Husain says that Frankincense should burn readily, showing that

it is not mixed with gum Arabic; should not emit much smoke, showing its freedom from Juniper resin. Moreover, he remarks that a kind of Frankincense is said to be produced in India which has a reddish tinge (probably an allusion to the gum resin of *Boswellia serrata*).

Olibanum is considered by the Mahometans to be hot and dry, and to have dessicative, astringent and detergent properties. It is used internally and externally in much the same way as we use the products of the Pines and Firs. In 1868, Olibanum was made official in the Pharmacopœia of India, where it is recommended in chronic pulmonary affections, such as bronchorrhœa and chronic laryngitis, employed both internally and in the form of fumigation. In the same work an ointment has been introduced which is said to be a good stimulant application to carbuncles, ulcerations, boils, &c. A good imitation of commercial Burgundy Pitch may be made by incorporating melted olibanum with water in a steam bath; a sufficiently good quality for this purpose can be purchased for Rs. 12 per cwt. Allcock's porous plaisters are said to be made of it.

Bombay is the centre of the Olibanum trade. The houses which deal in gums have agents in Arabia and Africa, who buy it up and forward it in a mixed condition. It passes through the Custom House as *Esesh* (a corruption of निशेष), and is next sorted into four or five different qualities. The first, consisting of all the large clean tears, is destined for the European market. The intermediate qualities and the last, which is only the dust and refuse, supply the Indian and China requirements. The Kishar Kundur or Kashfa of the Arabs forms a distinct article of commerce under the Indian name of *Dhup*. The method of collecting olibanum in Africa has been described by Cruttenden. (*Trans. Bomb. Geograph. Soc. VII.*, 1846, 121.) Carter in the same publication has described the collection of the drug in Southern Arabia. In both localities a simple incision in the tumid bark is made, and the product collected as soon as it becomes sufficiently hard. The collection is carried on from March to September in Africa, and

from May to December in Arabia. Balfour found several species of Boswellia growing on Socotra. Of these, *B Ameero* yields an olibanum which on examination by Prof. Dobbie and Dr. Henderson was found to have the same composition as Arabian olibanum. The stalactitic form of olibanum, called Lubán Meyeti, produced by *B. Frereana, Birdw.*, is occasionally met with in the Bombay market under the name of *Pandhri Esesh* or *Pandhri Lubán*; it differs from ordinary olibanum inasmuch as it contains no gum soluble in water.

Examination of some living cuttings of branches of **Boswellia Bhau-Dajiana,** *Birdwood, received from the Victoria Gardens, Bombay, by Mr. J. G. Prebble.*—On wounding the bark a milky fluid immediately exudes. This is faintly acid to litmus paper, and of an agreeable lemon odour and slightly bitter taste. Examination under the microscope shows the milky fluid to be a very fine emulsion of oil; by rubbing it between the cover glass and the slide, the globules of oil may be made to unite in larger drops. Two or three starch granules may be detected in a slide by the aid of the polariscope, but these are probably derived from the neighbouring starch cells and not from the secretory reservoirs. The emulsion is not coloured blue by iodine nor darkened by iron salts. A transverse section shows an outer layer of cork composed of thin-walled, compressed tangentially elongated cells of a yellow colour. It is this layer which is thrown off in thin dry, waxy-looking papery sheets, and hanging loosely about the stem is continually renewed from beneath. Next to the cork is a layer of parenchymatous cells mostly filled with a reddish brown colouring matter associated with tannin. This colouring matter is very little affected by the usual solvents. It is darkened in colour but not removed by solution of potash, but is readily soluble in acetic acid.*

* Professor J. L. de Lanessan found in the bark of the allied species *Boswellia papyrifera* "une matière colorante rougeâtre insoluble dans l'ammoniaque froid et bouillant, dans une solution bouillante faible d'acide sulphurique, dans l'alcöol et l'éther bouillants, légèrement soluble dans l'acide acétique bouillant."—(*Histoire des Drogues, tome* 1—268.)

Cells containing plenorhombic crystals of calcium oxalate are very numerous next the corky layer. Further within the bark are cells containing small oval or oblong starch grains giving a well defined cross with polarized light. The undulating medullary rays, composed of 2 or 3 rows of radially elongated cells, divide the liber into narrow wedges. The large, oval, intercellular secretory reservoirs which contain the milky fluid are mainly distributed in this layer in three or four interrupted and not very regular tangential rows. The lumen has an average measurement of 100 mkm., and is surrounded by two or three rows of secreting cells. A few secreting reservoirs occur in the outer bark, but they are not met with in the wood nor in the medulla.

Interspersed through the bark and sometimes forming an interrupted ring in the outer bark, are groups of refractive bast fibres. The wood is composed of narrow wedges of woody parenchyma containing numerous vessels. The medulla contains like the bark a reddish brown colouring matter blackened by iron salts. In longitudinal section the secretory reservoirs anastomise in a peculiar manner like the links in a chain, and the bast fibres frequently bifurcate. The medullary rays are composed of two or three rows of cells from six to twenty deep and not arranged in parallel rows.

According to the account of the Swiss traveller, G. A. Haggenmacher,* the bark is used by the Somalis for tanning. Assayed for tannin by Löwenthal's permanganate and gelatine process, and observing the details recommended by H. R. Proctor; 4·7 c. c. permanganate solution, 1 gramme per litre, was consumed by 20 c. c. of a decoction representing ·2 gramme of dry bark. Expressed in terms of oak bark using Oser's equivalent, these results give 4·7 per cent tannin extracted by boiling water.

Description.—Olibanum as found in commerce varies considerably in quality and appearance. It may be described as a dry gum-resin, consisting of detached tears up to an inch in

* Quoted by Flückiger, *Pharm. Journ.* [3] viii. 807.

length, of globular, pear-shaped, clavate, or stalactitic form, mixed with more or less irregular lumps of the same size. Some of the longer tears are slightly agglutinated, but most are distinct. The predominant forms are rounded—angular fragments being less frequent, though the tears are not seldom fissured. Small pieces of the translucent brown papery bark are often found adhering to the flat pieces. The colour of the drug is pale yellowish or brownish, but the finer qualities consist of tears which are nearly colourless or have a greenish hue. The smallest grains only are transparent, the rest are translucent and somewhat milky, and not transparent even after the removal of the white dust with which they are always covered, but if heated to about 94° C., they become almost transparent. When broken they exhibit a rather dull and waxy surface. Examined under the polarizing microscope, no trace of crystallization is observable. Olibanum softens in the mouth; its taste is terebinthinous and slightly bitter, but by no means disagreeable. Its odour is pleasantly aromatic, but is only fully developed when the gum resin is exposed to an elevated temperature. At 100° C. the latter softens without actually fusing, and if the heat be further raised decomposition begins. (*Pharmacographia.*)

Chemical composition.—Flückiger and Hanbury observe that cold water quickly changes olibanum into a soft whitish pulp, which when rubbed down in a mortar forms an emulsion. Immersed in spirit of wine, a tear of olibanum is not altered much in form, but it becomes of an almost pure opaque white. In the first case the water dissolves the gum, while in the second the alcohol removes the resin. They find that pure olibanum treated with spirit of wine leaves 27—35 per cent. of gum, the solution of which is precipitated by perchloride of iron as well as by silicate of sodium, but not by neutral acetate of lead. It is consequently a gum of the same class as gum Arabic, if not identical with it. Its solution contains the same amount of lime as gum Arabic affords. The resin of olibanum has been examined by Hlasiwetz (1867), according to whom it is a uniform substance having the composition $C^{20} H^{30} O^{3}$.

Flückiger and Hanbury find that it is not soluble in alkalis, nor have they succeeded in converting it into a crystalline body by the action of dilute alcohol. It is not uniformly distributed throughout the tears; if they are broken after having been acted upon by dilute alcohol, it now and then happens that a clear stratification is perceptible, showing a concentric arrangement. Olibanum contains from 5—7 per cent. of essential oil. According to Stenhouse it has a sp. gr. of 0·866, a boiling point of 179·4 C., and an odour resembling that of turpentine but more agreeable. Kurbatow separated this oil into two portions, one of which has the formula $C^{10} H^{16}$, boils at 158° C., and combines with HCl to form artificial camphor; the other contains oxygen.

Luban Meyeti, which is is considered by Flückiger and Hanbury as the *Oriental* or *African Elemi* of the older writers, and also one of the resins anciently designated *Animi*, has an agreeable odour of lemon and turpentine, and a mild terebinthinate taste. Treated with spirit of wine, ·838 of it is dissolved; the undissolved portion is not crystalline. Distilled with water it yields about 3 per cent. of a fragrant volatile oil having the odour of elemi, and a sp. gr. of ·856 at 16° C. The oil examined in a column 50 millim. long, deviates the ray 2°·5 to the left. It consists of a dextrogyre hydrocarbon, $C^{10}H^{16}$, mixed with an oxygenated oil, which is evidently levogyre, and exists in proportion more than sufficient to overcome the weak dextrogyre power of the hydrocarbon. No gum is present in this exudation. (*Pharmacographia*.)

Commerce.—Olibanum is shipped from Makulla, Aden, and other neighbouring ports to Bombay; as already mentioned, it is there sorted for the different markets. The trade is in the hands of Khojas and Banias. The price varies from Rs. 4 per cwt. for the dust to Rs. 20 per cwt. for the finest tears. Bombay exports from 25,000 to 30,000 cwts. annually. Nearly four-fifths of this quantity go to Europe, and the rest to China.

BOSWELLIA SERRATA, *Roxb.*

Fig.—*Colebr. in Asiat. Res. IX.*, 379, *t.* 5. Salai tree, (*Eng.*).

Hab.—W. Himalaya, Central India. The gum-resin.

Vernacular.—(The gum-resin) Salai, Gúgal (*Hind.*), Gugar (*Guz.*). In Southern India it bears the same names as olibanum.

History, Uses, &c.—The history of this drug is involved in much obscurity, owing to it shaving been confounded by both native and European writers with true Frankincense and Bdellium. Sanskrit writers may possibly sometimes allude to it when they speak of Kunduru, but as this word is evidently the same as the Arabic Kundur, it is much more likely that they allude to the true Frankincense imported from Africa and Arabia, and which we know to have been introduced into India at a very remote period. Mahometan writers have probably included the produce of *B. serrata* among the different kinds of Mukul for which they give as the Indian synonym Gúggul. It seems probable that the true Sanskrit name for *B. serrata* is Sallaki, from which the Hindí word Salai has been derived. The exudation from the tree is called Sallaki-drava or Sihla, and Guggulu. Ainslie notices *B. glabra* as producing Gúggul, and *B. serrata* the olibanum of commerce, but calls the latter *Salai,* and quotes Dr. F. Hamilton's MS. account of Shahabad, where the tree is said to be very common and to yield a resin called *Sale-gond* or *Sale-lassa, which is not used.* Dr. Hamilton describes it as of the consistence of turpentine when it flows from the tree; in this state it is called at Chandalghar Gandah-biroza, and in the dry state Sukha-biroza. (*Mat. Ind.* 1, 226.) Other European authors make the same mistake with regard to the source of commercial olibanum. *B. glabra* is now considered to be only a variety of *B. serrata*. *B. serrata* is one of the commonest trees in some parts of Khandesh, Loonawara, and other neighbouring territories; the gum-resin is obtained by incising the bark. Dr. Hooker, when ascending from Belcuppee in Behar to the height of 1,360 feet, came upon a

small forest of these trees, which he likens to the mountain ash. Dr. Irvine remarks that the tree is very plentiful in the Ajmeer hills, where the gum-resin is called Ganda-biroza, and is similar in appearance to Venice turpentine. Dr. O'Shaughnessy obtained fine specimens from the Shahabad country. The collection of Gúggul is a source of revenue to the Bhils, and a stake cut from the tree is set in the ground when a marriage takes place among them. Sanskrit writers describe Guggulu as moist, viscid, fragrant, and of a golden colour when freshly exuded—a description which is not applicable to the exudation of the Balsamodendrons, but is exactly so to the exudation of *B. serrata.* It is said to be demulcent, aperient, alterative, and a purifier of the blood. The Yogarája gúggula is a well known alterative compound; it contains Guggal 25 parts, Triphala 15 parts, ginger, long pepper, chavak, pipalimul, chitrak, hing, ajmod, siras, jira, shahjira, renuka, indrajao, paharmul, baberang, kutki, atis, bharingi, vekhand, of each one part, morvel two parts. The whole is made into a pill mass, the dose of which is from 3 to 5 grains, to be taken with a decoction of *Sphæranthus indicus.* It is used in rheumatism, nervous diseases, scrofulous affections, urinary disorders and skin diseases, and is generally combined with aromatics.

Description.—The fresh exudation has the colour and consistence of Canada Balsam ; it hardens very slowly, retaining its golden colour and transparency. The odour is that of olibanum, but fainter and more terebinthinate ; cold water converts it into a soft whitish pulp, which, when rubbed in a mortar, forms an emulsion. Spirit also makes it white and opaque by dissolving the resin. In short, it has the characters of olibanum, but does not harden like that article. It burns readily, and diffuses an agreeable odour.

Commerce.—Gúggal is not exported from India, but is consumed in Central and Northern India as an incense and medicine.

A large quantity is collected in the Satpoora forests, where it is sold on the spot at 12 lbs. for a rupee.

BALSAMODENDRON, *Sp. var.*

Fig.—*Bentl. and Trim., t.* 60.

Hab.—Africa, Socotra, Arabia. Myrrh.

Vernacular.—Bol (*Hind., Beng., Guz.*), Vellaip-polam (*Tam.*), Bálimtra-polam (*Tel.*), Bolá (*Can.*), Bálata-bola (*Mar.*).

History, Uses, &c.—Myrrh was known to the ancient Egyptians, Professor Dümichen has discovered an inscription at Deir el Bahari which records an expedition to the balsam land of *Punt* (the modern Somali country), undertaken by Hatasu, a queen of the XVIIIth dynasty, who lived about 1700 years B. C. Through this expedition, we learn from the inscriptions, "thirty-one verdant myrrh trees" were introduced into Egypt, besides a large quantity of myrrh. In a drawing on the walls of Hatasu's temple at Deir el Bahari there is a reprsentation of myrrh trees planted in wooden tubs and heaps of myrrh, which are recorded as having been "brought over the ocean to Egypt." The inscriptions which refer to these trees give very exactly the place from whence they came. They were, we are told, "brought over the sea in ships from the incense mountains of the Somali country." These mountains, we are further told, formed the "best district of the incense-land." In another drawing on the Deir el Bahari monnment, may be seen a figure of one of these trees. It represents a medium size tree with somewhat thick trunk and spreading branches. The leaves are oval, and appear to terminate in an acute point. There is also shown, exuding from the stem in the form of tears, a gum-resin, which in the original is coloured red. Myrrh was also imported into Egypt from Socotra. An inscription on the walls of Thothmes III.'s temple at Karnak, erected about 1600 B. C., records an expedition undertaken by that king to this island, for the purpose, it is related, of introducing "all the beautiful plants of that country." Many of the plants are figured on the walls of the Karnak temple, and among them is undoubtedly one which represents the myrrh tree. Myrrh was also imported from Arabia, as is shown from a sentence in the Papyrus

Harris written in the time of Rameses the III., about 1250 B. C., and several inscriptions of a later date. (*Newberry in Pharm. Journ., Nov.* 17, 1888.) Myrrh is not much used by the Hindus. It is called Vola in Sanskrit, a word which appears to be the same as the Greek βωλος and the English Bole, signifying a lump of earth or clay. It is described as useful in fever, epilepsy, and uterine affections, and is given to women for eleven days after confinement mixed with molasses to purify the womb. The similarity of its properties to those of Bdellium, which is an article of importance in Hindu medicine, probably accounts for its not having greatly attracted the attention of the Hindus upon its introduction into India from the West. The Greeks and Romans used it to flavour their wine; they also anointed their hair with a perfumed unguent made from it: "lautissima apud priscos vina erant, myrrhæ odore condita." *Plin.* 14, 15; "crines myrrha madidi," *Ovid. M.* 10, 298, *et seq.* It is the σμυρνα of Dioscorides, I., 69. According to a Greek myth, Myrrha, ashamed of her incest with her father Cinyrus, begged the gods to change her into some object neither dead or alive: she became the Myrrh tree. With the Mahometans Myrrh is an important article of the Materia Medica. They describe the tree which produces it as tall and handsome, with knotted branches, a native of Socotra and neighbouring countries, and say that spears are made of the branches, which are solid and free from pith; that the juice when it first exudes is white and milky, and that the best Myrrh is obtained by making incisions in the tree. What exudes of itself is called Batáreh.* After the trees have been wounded, mats and vessels are placed to catch the juice. Balfour found several species of Balsamodendron growing in Socotra, one of which was a tree 30 feet high and very fragrant, but he did not obtain any of the gum-resin. This plant is named by him *B. socotranum*, and has points of resemblance with *B. Myrrha, Nees*, a myrrh-bearing tree of Somali land. According to Mir Mohammad Husain the best Myrrh should be of a reddish yellow colour, and the surface covered with a pale dust. When broken it

* مر البطارح

should show white marks like those at the root of the finger nail. The same authority says that Myrrh is hot and dry; detergent, siccative, astringent and aperient, a disperser of cold tumours, and one of the most important of medicines, as it preserves the humours from corruption. It is much used externally as a stimulant and disinfectant application to ulcers, sores, &c. Dissolved in women's or asses' milk it is dropped into the eye in purulent ophthalmia. As an internal remedy it is given in coughs, in atonic dyspepsia, diarrhœa, amenorrhœa, worms, &c. It is also thought to keep away fever, and prevent the hair falling off. Administered by means of fumigation it is said to have the same effect as when taken in the ordinary way. The leaves, fruit, and wood are said to partake of the same properties as the gum-resin. The history of the use of Myrrh in Europe goes back to a very early date. A good summary will be found in the *Pharmacographia.* Bombay is the centre of the Myrrh trade. The merchants who deal in the gums which come from the north-east of Africa and Southern Arabia, have their chief houses here, and employ partners or agents at Aden and Makalla; the Aden agents also attend the great annual fair at Berbera on the opposite coast, and exchange English and Indian goods for Myrrh, Bdellium and other African produce. The bags or bales which contain the Myrrh, when opened in Bombay, are found to be made up of—*1st,* a large proportion of roundish masses of fine Myrrh; *2nd,* a considerable proportion of small semi-transparent pieces of Myrrh of irregular shape; *3rd,* numerous pieces of dark-coloured Myrrh, mixed with bark and other refuse; *4th,* a small proportion of an opaque gum-resin (Bdellium opaque of Guibourt), occasionally pieces of resin (juniper?) are also met with. In Bombay the contents of the package are sorted; the best Myrrh goes to Europe; the darker pieces form a second quality, and the refuse is exported to China, where it is said to be used as an incense. True Myrrh is known in the Bombay market as *Karam* or *Bandar Karam.** From Makalla and Aden another kind of Myrrh is received, Arabian Myrrh. The trade name of this

* A seaport on the African coast nearly opposite Aden.

drug in Bombay is Meetiya; it is mostly sold in India as true Myrrh, for which it might easily be mistaken by any one not specially acquainted with drugs. The dealers here say that no true Myrrh is ever received from Arabia. A kind of myrrh resembling Meetiya is sometimes sold in Bombay as Chenai-bol or "Chinese myrrh," and it is curious that Ibn Batuta (1340) amongst the articles of trade at Thana, mentions musk and myrrh from China. Persian Myrrh has only recently made its appearance in the market; it occurs in very large masses of a rich reddish brown colour and considerable translucency; very oily; in taste and odour it resembles African Myrrh very closely. Pieces of papery bark are found adhering to it. It comes principally from Mekran, and is probably the Myrrh mentioned by Arrian as having been found by Alexander's army in the country of the Γαδρωσοί. It readily forms an emulsion with water, and appears to have all the properties of commercial Myrrh.* The botany of the Myrrh trees is still encompassed with uncertainty, which cannot be removed until the very localities in which the drug is collected shall have been explored by a competent observer. At present all we can say is that it is probable that Ehrenberg's or Carter's Balsamodendron produces the Arabian Myrrh, and that a much larger species, probably *B. Myrrha, Nees.*, growing in north-eastern Africa, produces the true Myrrh of commerce. It seems probable also that Balfour's *B. socotranum* is a myrrh tree. Of the source of the Persian Myrrh we know nothing as yet.

Description.—Myrrh consists of irregular roundish masses varying in size from small grains up to pieces as large as an egg, and occasionally much larger. They are of an opaque reddish brown, with dusty dull surface. When broken they exhibit a rough or waxy fracture, having a moist and unctuous appearance, especially when pressed, and a rich brown hue. The fractured translucent surface often displays characteristic whitish marks which the ancients compared to the light marks at the base of the finger nails. Myrrh has a peculiar and

* In 1882 the imports of Persian Myrrh rose to 1,000 cwts.

agreeable fragrance, with an aromatic bitter and acrid taste. Water disintegrates it, forming a light brown emulsion which, viewed under the microscope, appears made up of colourless drops, among which are granules of yellow resin. Alcohol dissolves the resin of Myrrh, leaving angular non-crystalline particles of gum and fragments of bark. (*Pharmacographia.*)

Chemical composition.—Flückiger and Hanbury say:—"The gum which is dissolved when Myrrh is treated with water amounts to between 40 to 50 per cent. It is partially precipitable by neutral acetate of lead, showing that it differs from gum Arabic; but a portion (about one-fourth) agrees with the latter in respect to its action on acetate of lead. The resin dissolves completely in chloroform or alcohol, and the colour of the latter solution is but slightly darkened by perchloride of iron.* It is but partially soluble in alkalis or in bisulphide of carbon. Brückner (1867) found this portion to yield 75·6 per cent. of carbon and 9·5 of hydrogen. The resin which the bisulphide refuses to dissolve is freely soluble in ether. It contains only 57·4 per cent. of carbon. The resin of Myrrh to which when moistened with alcohol a small quantity of hydrochloric acid is added, assumes a violet hue, but far less brilliant than that displayed by resin of Galbanum when treated in a similar manner. Myrrh yields on distillation a volatile oil, which in operating on 25 lbs. of the drug, we obtained to the extent of $\frac{3}{4}$ per cent.† It is a yellowish, rather viscid liquid, neutral to litmus, having a powerful odour of Myrrh and sp. gr. 0·988 at 13° C. In a column 50 mm. long, it deviates a ray of light 30·1° to the left. By submitting it to distillation, we obtained before the oil boiled, a few drops of strongly acid liquid having the smell of formic acid. Neutralized with ammonia, this liquid produced in solution of mercurous nitrate a whitish precipitate, which speedily darkened, thus indicating formic acid, which is developed in the oil. Old Myrrh is in fact said

* The proportion of resin in Myrrh is variable, Flückiger has found the finest samples to yield as much as 27 per cent.

† Distilled on a large scale, good Myrrh yields as much as 4·4 per cent.

to yield an acid distillate. The oil begins to boil at about 266° C., and chiefly distils over between 270° and 290°.

"On combustion in the usual way it afforded carbon 84·70, hydrogen 9·98. Having been again rectified in a current of dry carbonic acid, it had a boiling point of 262 to 263° C., and now afforded carbon 84·70, hydrogen 10·26, which would nearly answer to the formula $C^{22} H^{32} O$. The results of Ruickhold's Analysis (1845) of essential oil of Myrrh assign it the formula $C^{10} H^{14} O$, which is the same as that of carvol and thymol, and widely different from that indicated by our experiments. The oil which we rectified displays a faintly greenish hue; it is miscible in every proportion with bisulphide of carbon, the solution exhibiting at first no peculiar colouration when a drop of nitric or sulphuric acid is added. Yet the mixture to which nitric acid (1:20) has been added, assumes after an hour or two a fine violet hue, which is very persistent, enduring even if the liquid is allowed to dry up in a large capsule. If to the crude oil dissolved in bisulphide of carbon bromine be added, a violet hue is produced, and if the solution is allowed to evaporate, and the residue diluted with spirit of wine, it assumes a fine blue, which disappears on addition of an alkali. The oil is not altered by boiling with alcoholic potash, nor does it combine with alkaline bisulphites.

"The bitter principle of Myrrh is contained in the resin as extracted by alcohol. By exhausting the resin with warm water an acid brown solution is obtained, from which a dark, viscid, neutral mass separates if the liquid is concentrated; it is contaminated with a large amount of inorganic matter, from which it may be purified by means of ether. Yet the latter affords also but an amorphous, somewhat brittle brown substance, softening at 80°—90° C. This bitter principle is but sparingly soluble in water, and the yellowish solution is intensely bitter. The bitter principle of Myrrh appears to be a glucoside."

Commerce.—The sources of supply have been already noticed. Value, Bander Karam, Rs. 34 per maund of 37½ lbs.; Meetiya, Rs. 16 to 25 per maund; refuse, Rs. 8 per maund.

Other allied Gum Resins.—From Berbera also comes *Bdellium* (*Vern.* Mhaisábol, or Bysabol*). In the bales of this drug two distinct kinds are met with, *viz.*, ordinary Bdellium, which to a certain extent resembles Myrrh, but is of a darker colour, less oily, and has a peculiar odour destitute of the aroma of Myrrh, and a perfumed kind called by the Arabs *Habak-Hadee*,† which occurs in irregular-shaped pieces more or less flat, some of them having earth and fragments of bark adhering; it is of a dark reddish brown colour, but opaque yellowish white streaks run through the semi-transparent reddish mass. The odour is more powerful and more perfumed than that of common Bdellium; the taste perfumed, aromatic, and feebly bitter, whereas common Bdellium is strongly bitter and has hardly any aroma. *Indian Bdellium* (*Mhaisagúggal*), *the produce of B. Mukul,* somewhat resembles the African drug in general appearance, the pieces often having portions of papery bark attached to them, but the colour is lighter, often greenish; the odour and taste are somewhat different, and a certain proportion of it is in distinct vermiform pieces as thick as the little finger. Its value is one-third less than that of African Bdellium. *Opaque Bdellium* is found in small quantities in the packages of Myrrh and other gums which come from Africa. It is known in Bombay as *Meenaharma,* and is of a yellowish white colour; and quite opaque like ammoniacum ‡; it has hardly any odour, but a very bitter taste. The native practitioners use it to facilitate the extraction of Guinea-worms; it would appear to poison the animal, as it makes it loosen its hold upon the tissues. *Indian Bdellium* (*Mhaisagúggal*), *the*

* Buffalo Myrrh, because it is given to these animals to increase the flow of milk, from the Sanskrit Mahisha, a buffalo, and Vola, myrrh. It is also called in Sanskrit Sáindhava or Samudriya gúggula, as coming from beyond the sea.

Dioscorides (i., 71,) mentions three kinds of *βδελλίον*. Indian Bdellium he says, is dirty and dark-coloured, and is called *ἁδρόβωλον*, i.e., *sticky bole*. Arabian Bdellium is described as dry, resinous and bluish or greenish black. His third kind is probably a kind of Myrrh.

† Pliny 12, 35, mentions an odoriferous myrrh.

‡ It is perhaps the white myrrh of Pliny, 12, 35.

produce of B. Roxburghii, occurs in irregular lumps, covered more or less with dirt and hair, to which portions of papery bark as well as the thick inner bark sometimes adhere; it is of a greenish yellow colour, with an occasional tinge of red; consistence waxy, soft, and brittle; odour peculiar and balsamic, something like cedarwood; taste bitter. With water it forms a greyish-white emulsion; when inflamed it swells and sputters instead of burning with a clear flame like the Gúggal of *Boswellia serrata.* We have been favoured by Mr. Woodrow with fresh specimens of the stem and exudation of *B. Roxburghii* collected near Peit, about 30 miles north of Poona, where the tree has been planted to form a hedge round a Hindu temple.

Description.—The epidermis of *Balsamodendron Roxburghii* consists of several rows of delicate elongated cells, containing a little granular matter; the cells beneath this, which form the green bark, are loaded with chlorophyll and starch. Proceeding inwards the chlorophyll gradually diminishes, and a few bundles of liber cells are met with, forming a broken irregular zone. Within this the cells contain granular matter, starch, and globules of balsam; balsam-ducts permeate the bark at intervals, and the medullary rays are distinctly traceable; a few conglomerate raphides are met with. The wood, which is white, soft and brittle, consists of elongated thin walled cells divided into zones; in the zone next the bark the cells (18 to 20 rows) are empty, or contain a little starch; in the next they are smaller and loaded with large starch granules. The same kind of structure is continued to the central pith, which consists of cells of starch. The exudation of this tree as cultivated at Peit is at first opaque and milky; as it dries it becomes greenish and translucent, and finally solidifies. Mahometan writers describe the different kinds of Bdellium under the name of *Mukul,* and say that it is the produce of a large tree common in Arabia and the neighbouring countries, and also in India. They distinguish several kinds, all of which are bitter. That having a reddish tinge they call *Mukul-i-azrak*; the yellowish, *Mukul-i-*

yahud; the brown, *Sakalabi*; and the rich reddish brown, *Mukul-i-Arabi*. Good Bdellium should be clean, bright, sticky, soft, sweet-smelling, yellowish, and bitter; when burnt it smells like Bay; it mixes readily with water, and is described as hot and dry; from the account of its properties in the Makhzan-el-Adwiya, it would appear to be used in very nearly the same way as myrrh. The cheaper kinds of Bdellium are largely used to give adhesiveness and polish to the fine plaster used by masons upon the ceilings and pillars of houses; for this purpose the gum is dissolved, strained, and mixed with molasses. Indian Bdellium combined with Black pepper and Colchicum has a reputation in muscular rheumatism; it is given internally, and also applied to the painful part as a *lép*.

Chemical composition.—Flückiger remarks that Bdellium differs from myrrh in its stronger, almost acrid taste and in odour; it contains very little resin; this resin is different from that of myrrh, being paler and redder; it is very sparingly soluble in bisulphide of carbon; this solution is not altered by bromine, whilst that of true myrrh resin assumes a most intense violet colour; it is not soluble in petroleum ether. Of the gummy substance, which is by far the prevailing constituent of this drug, a small portion only is soluble in water. Parker has examined opaque bdellium with the following result:—"*Opaque Bdellium* (*Balsamodendron Playfairii*) is a very hard, yellow ochre-coloured, opaque gum-resin, with but slight odour and a bitter taste. In common with other exudations from the genera *Balsamodendron* and *Boswellia,* tears of this substance frequently have portions of papery bark attached to their surface. Triturated with water, opaque bdellium forms a very good cream-coloured emulsion. Cold absolute alcohol dissolves about 50 per cent.; the residue is not entirely soluble in water, the soluble portion swelling up and giving the characters of bassorin.

"The colouring matter appears to be due to a resin very soluble in alcohol, giving a canary-yellow coloured tincture; this resin is also soluble in ether, benzol and chloroform. The tincture (1 of gum-resin to 6 of rectified spirit) becomes

slightly milky with alcoholic solution of plumbic acetate, gives a slight yellow precipitate with one drop of liq. plumbi subacet., and an intense greenish-black colour with tinct. ferri perchlor. It is bitter and becomes milky with water.

"The mucilage made by dissolving 1 part of the gum (completely washed with rectified spirit) in 40 of water, is tasteless, partly precipitated by subacetate of lead and not at all by neutral acetate.

"The ash (1·6 per cent.) appears to be chiefly calcic carbonate, dissolving entirely with effervescence in dilute acetic acid, and giving a copious precipitate with ammonium oxalate.

"Water distilled from opaque bdellium had the slight odour of the drug, but there was no appearance of oil globules in working on a small scale.

"Composition of opaque bdellium—

Soluble in alcohol (by difference)	47·42
Gum soluble in water	30·01
Gum insoluble in water	11·07
Moisture...	11·50
	100·00."

—*Pharm. Journ., July 17th*, 1880.

Commerce.—The source of African Bdellium has already been noticed.* Indian Bdellium is produced in the Central Provinces, Cutch and Sind. Value, African, Rs. 8 per maund of 37½ lbs.; Indian, Rs. 3⅝ to Rs. 4 per maund.

B. pubescens (Bayee of the hill Beloochees) yields a small quantity of a tasteless, inodorous, brittle gum almost entirely soluble in water, which is not an article of commerce, *cf.* Stocks in *Phar. Journal* (i.), Vol. IX., p. 275), where figures of *B. Mukul* and *B. pubescens* will be found. Combined with sulphur, catechu and borax it has been recommended by

* The plant, which is now growing at Kew, and was brought home by Mr. Wykeham Perry as the Bysabol plant, and which was identified by Bentley and Trimen in 'Medicinal Plants' as *Hemprichia erythræa*, has been identified by Professor Engler, as the var. *glabrescens* of that plant.

Dr. J. Newton as a stimulating application to Delhi boils, to promote healthy granulation.

B. Berryi, *Arn., Bedd. Fl. Sylv. t.* 126, yields a gum-resin which affords 84 per cent. of a good adhesive gum allied to arabin, and a soft, white, neutral, tasteless, and odourless oleo-resin soluble in alcohol, ether and chloroform. The resin does not give the same colour reactions with bromine and with concentrated hydrochloric acid as that of the true myrrh.

BALSAMODENDRON PLAYFAIRII, *Hook. f.*

Hab.—Arabia, North Africa.

Vernacular.—Hotai (*Somali*), Dukh (*Indian name in Muscat*), Dijj (*Arabic*).

History, Uses, &c.—This is the name of a gum-resin produced by a small thorny tree which grows in the Somali country about Bunder Murrayah; the shrub is described as about six feet high, and not unlike the Myrrh. The gum-resin is used by the Somali women as a detersive for the hair. Dr. Jayakar of Muscat informs us that it is principally used by the Arabs in Oman for washing clothes: a small piece is tied in a rag and allowed to soak in the water for a few minutes, when it is placed in the clothes to be washed and well beaten with a piece of wood. It is also used for washing the body; for this purpose a piece is soaked in water and well stirred, so as to produce a froth like soapsuds upon the surface; the froth is then rubbed over the skin. Dijj is also an ingredient in a *Hibar* (plaster) used in cases of local injuries, particularly those of the chest, also in rheumatic affections. Internally it is administered as an expectorant and is an ingredient of a suppository for piles.

The method of administering Dijj internally consists in taking a small piece of it, about half the size of an ordinary marble, and rolling it in a small piece of peeled lime fruit; it is then swallowed. This dose is given twice or thrice daily. (*Jayakar.*) According to the Arab lexicographers, the name

of this gum is دجاج Dijaj or Dajjáj, and it is described under that name in the Makhzan-el-Adwiya as a gum like olibanum brought from the mountains of Oman, which is better than soap for washing clothes, as it makes them whiter; it is also said to be a useful application to wounds to remove proud flesh and promote healing; when made into a paste with honey it is applied to chronic rheumatic swellings of the limbs. (*Op. cit., article Dajjáj.*) Vaughan sent a sample of Hotai from Aden to Hanbury, who gives the following description of it:—

"Irregular pieces 1½—1 inch in their longest diameter, frequently rounded on one side, as if portions of large tears, of entire smaller tears, and of irregular little fragments produced by the fracture of the masses. It is of wax-like opacity, cracked in all directions, and readily breaking up into angular, pieces; on the exterior the larger pieces are yellowish-brown or somewhat liver-coloured, and occasionally encrusted on one side with a reddish sand, upon which they appear to have fallen when in a soft state; internally the colours are generally paler or nearly white, sometimes darker towards the centre of the tear. The gum is nearly inodorous, but in taste is slightly bitter and acrid to the throat. A few fragments agitated with water in a phial speedily afford an emulsion, which remains frothy and milky for many days."

Bentley and Trimen have suggested that Hotai may be the same as Opaque Bdellium, but Parker (*Pharm. Jour., July 17th,* 1880,) has pointed out that tincture of the latter gum-resin gives an intense greenish-black colour with tincture of perchloride of iron, whereas gum Hotaî gives no such reaction.

BALSAMODENDRON OPOBALSAMUM, *Kunth.*

Fig.—*Bentl. & Trim., t.* 59. Balsam tree (*Eng.*), Balsamier de la Mecque (*Fr.*).

Hab.—Arabia. The balsam, wood, and fruit.

Vernacular.—The balsam, Balasán (*Arab., Pers., Ind*); the fruit, Hab-el-Balasán (*Arab., Ind.*), Tukm-i-Balasán (*Pers.*); the wood, Ud-i-Balasán (*Pers., Ind.*).

History, Uses, &c.—This is the βαλσάμον of the Greeks, (Dios. i., 18; Theophr. H. P. IX. 1, 2, 6, 7,) and the Balsamum of the Romans (Plin. 12, 54). Dioscorides also notices the use of the fruit (*carpobalsamum*) and wood (*xylobalsamum*). Arabic and Persian writers describe the Balsam tree as having hoary leaves like rue, and say that it is affected by heat and cold, drought and moisture, like a human being. They affirm that it sprang from the blood of the slain in Mahomet's conflict with the tribe of Harb, and that the Prophet used the Balsam for the resuscitation of the dead. Sheik Dawood of Antioch says that the Christians have a tradition to the effect that when the Holy Virgin Mary and our Lord fled to Matriya in Egypt, our Lord washed His clothes at a well, and from the waste water which ran upon the ground, the Balsam tree sprang up, that on this account the tree is held in great veneration by the Christians, who value the Balsam at its weight in gold. The wood is called Ud-i-balasán; it is heavy and red, with yellowish bark. Genuine Balasán when thrown into water sinks; cotton dipped in it can be washed quite clean in water; when rubbed upon a stick and inflamed it should burn without injuring the wood, like naphtha. (*Makhzan-el-Adwiya, article Balasán.*) Abd-el-Latif, who lived from 1161 to 1231, has described the extraction of the Balsam at the garden of Matriya near Cairo. He says that incisions are made with a sharp stone through the bark down to the wood, the juice is scraped from the tree by the fingers,* and preserved in bottles which are buried in the earth for a time, and afterward exposed to the sun until all the Balsam has separated from the impurities; it is then subjected to some secret process after which it is stored in the king's treasury. The annual produce of the garden is about 20 ratls. (*Husn-el-muhásarin fi akhbár Misr wa el Kahirah.*) The Balsam is also extracted

*. Theophrastus says ὄνυξι σιδήροις.

by boiling the leaves and wood in water. P. Bellonius (*Obs. Lib.* II., cap. 39 and 40) describes a visit to the Matriya gardens for the purpose of seeing the Balsam trees in A.D. 1547.

Description.—Balsam of Mecca, when freshly imported into Bombay, is a greenish turbid fluid of syrupy consistence having a very grateful odour, something like oil of rosemary, when dropped into a vessel containing water it rises and forms a thin film upon the surface of the liquid, which after about a quarter of an hour can be raised entire by touching it with a pencil. When rubbed upon the palm of the hand for a few minutes, it loses its essential oil and becomes very sticky; dissolved in six parts of alcohol 60 O. P. it forms a turbid greenish solution with many opaque flakes floating in it; these are soon deposited and adhere to the bottom of the bottle. The alcohol solution dropped on paper and placed in the sun rapidly evaporates, leaving a slightly sticky varnish upon the surface of the paper. The Balsam itself dropped upon common scribbling paper spreads a little and soon becomes very thick; the paper beneath the drop becomes translucent only; after 12 hours it becomes so hard that when touched it no longer adheres to the finger.

Treated with six parts strong sulphuric acid, the Balsam forms a rich red brown translucent solution of the colour and consistence of Stockholm tar, which upon being poured into water throws down a dull brown resinous deposit. Balsam of Mecca, which has been kept some time in the shops, becomes yellowish and more viscid; the essential oil would appear to be very volatile, as after a short exposure the Balsam does not render paper translucent, and has a simply terebinthinate odour. The taste is aromatic, bitter, and somewhat acrid. It would thus appear that the balsam imported into India is very nearly of the same charactor as that described by Guibourt and supplied to him by M. Delessert, only that being fresher it differs in colour and contains more essential oil.

Chemical composition.—Trommsdorff found in a sample of this Balsam 30 per cent. of volatile oil, 64 per cent. of hard

resin, 4 per cent. of soft resin, and 0·4 per cent. of bitter principles. The volatile oil was mobile, colourless, fragrant and had a rough taste; it dissolved in alcohol and ether, and with a deep red colour in sulphuric acid, whence it was precipitated by water as a resin. It was also resinised by nitric acid. The hard resin was honey yellow, transparent, brittle, of specific gravity 1·333, softened at 44° C., and melted completely at 90° C. It dissolved with difficulty in alcohol and ether at ordinary temperatures, easily with aid of heat; it was likewise soluble in oils, both fixed and volatile. It was altered by hot nitric and sulphuric acids, and appeared to combine with alkalies, forming compounds insoluble in free alkali. The soft resin was brown and very glutinous, inodorous and tasteless; melted when dry at 112° C. It was insoluble in alcohol and ether, but soluble in oils, both fixed and volatile. It was not attacked by alkalies or by strong sulphuric acid; with nitric acid, it swelled up and became friable.

Hab-el-Balasán.—The fruit is imported from Arabia and is kept by all the native druggists who deal in what are called in India "Mughlai" or "Yunani" medicines; it has a pleasant terebinthinate odour, and exactly corresponds with the figures and description of the fruits of *B. Opobalsamum* in Bentley and Trimen's "Medicinal Plants." If soaked in water they soften and can be easily dissected, and the remarkable form of the pulpy layer within the epicarp be seen. Sections of the epicarp show very large ramifying balsam cells, which appear to communicate one with another. The fruit is considered to be a powerful carminative and digestive; it is also praised as a stimulant expectorant, and is usually administered in combination with tragacanth.

Commerce.—Balm of Mecca, Rs. 8 per lb.; the fruit, Re. ½ per lb.

GARUGA PINNATA, *Roxb.*

Fig.—*Roxb., Cor. Pl. iii., t.* 208; *Rheede, Hort. Mal. iv., t.* 33.

Hab.—India. The fruit and juice.

Vernacular.—Ghogar, Kharpat (*Hind.*), Kankar, Kurak, Kusar (*Mar.*), Jum (*Beng.*), Karivembu maram (*Tam.*), Garuga chettu (*Tel.*).

History, Uses, &c.—Throughout India the fruit of this tree, which is greenish yellow and about the size of a gooseberry, is pickled and eaten as a cooling and stomachic remedy; it is strongly acid. The bark is astringent, and is employed in tanning. (*Brandis.*) Its juice, which is gummy and resinous, is dropped into the eye to cure opacities of the conjunctiva. In the Concan the juice of the leaves, with that of *Adhatoda Vasica* and *Vitex trifolia*, mixed with honey, is given in asthma.

Description.—The gum-resin is greenish yellow, translucent, in small mamilliform masses, having a mild terebinthinate odour and taste, not unlike that of some sample of elemi. Only a small part of it is soluble in rectified spirit.

Chemical composition.—The gum-resin contains 76·5 per cent. of gum, 13·9 per cent. of resin, and 9·6 per cent. of moisture, including volatile oil. The gum is precipitated by ferric salts, but not by neutral plumbic acetate, it is therefore similar to that of myrrh. The resin is neutral, soluble in spirit of wine and ether, but not in alkalies. A clean sample of the gum-resin left 3·75 per cent. of ash.

CANARIUM STRICTUM, *Roxb.*

Hab.—Western Peninsula. The resin. Black Dammar (*Eng.*).

Vernacular.—Kala-dámar (*Hind.*), Karrapu-dámar (*Tam.*), Nalla-rajan (*Tel.*).

History, Uses, &c.—The black dammar tree of Malabar is common about Courtallum in the Tinnevelly district and in Canara. In the Wynaad the Kurchias light a fire at the base of the tree, on the side to which it is inclined. When the bark has been charred the resin begins to exude;

about five or six months after it is removed in large stalactitic masses. It is used in India for many small purposes, such as the manufacture of bottling wax, varnishes, &c. Dr. Bidie speaks of it as an excellent substitute for Burgundy pitch.

Description.—The resin is transparent and of a deep brownish yellow to amber colour when held between the eye and the light, but when adhering to the tree it has a bright shining black appearance. Its colour when in solution is pale, as compared with its dark tint when in mass; though insoluble in spirit, its solution in turpentine forms a tolerable varnish. When submitted to destructive distillation it yields about 78 per cent. of oil, resembling that obtained from common colophony.

Commerce.—The high price of black dammar, about Rs. 32 per cwt. (*Beddome*), precludes its use as a substitute for colophony, nor can it compete with olibanum as a plaster material.

CANARIUM COMMUNE, *Linn.*

Fig.—*Kœning. Ann. Bot. i.* 360, *t.* 7, *f.* 2; *Bentl. and Trim.* 61. Java almond (*Eng.*), Bois de colophane (*Fr.*)

Hab.—Penang, cultivated in Southern India.

Vernacular.—Kánári (*Malay*).

History, Uses, &c.—This tree is described and figured by Rumphius (*Herb. Amb. II., tt.* 47, 48,) as a large tree growing at Ceram and in the neighbouring large islands which produces resin so abundantly that it hangs in large pieces and conical tears from the trunk and principal branches. The resin is at first white, liquid and sticky, but afterwards becomes yellowish and of the consistence of wax. Rumphius also mentions the almonds, which he says are apt to bring on diarrhœa and dyspepsia if eaten raw. Sprengel suggests (*Hist. Rei Herb. ii., p.* 270,) that the almonds are the منشم (Manshim) of Ibn Sina, which that author describes as

three-angled seeds like those of the بطم (*Pistacia Terebinthus*), but the Arabian lexicographers consider manshim to be Carpobalsamum. Ainslie says:—"We are told by Horsfield in his list of medicinal plants of Java, that the gum has the same virtues as Balsam of Copaiba, that the three-cornered nuts are eaten both raw and dressed by the natives, and that the oil is used at table when fresh and for burning when stale." The resin is also said to be burnt as a light. Dr. Waitz (*Diseases of Children in Hot Climates*, p. 290), speaks favourably of an emulsion of the kernels as a substitute for Mistura Amygdalæ, to which he considers it preferable on account of its mild laxative action. Guibourt (iii., p. 520) notices the resin under the name of *New Guinea Resin with an elemi odour.*

Planchon (*Drogues Simples* ii., 244), speaking of the resin of this tree, says that under the name of *East Indian Elemi* it has occasionally appeared in commerce at Amsterdam as an import from the Dutch Colonies. In Java the tree is cultivated for its seeds; in India it is grown most successfully in Travancore.

Description.—The resin occurs in large dry masses of a yellowish-white colour, it readily softens when heated, and has then an odour like elemi.

The fruit is from 1¼ to 1½ inch long, ovoid, 3-angled, pointed at the apex, smooth, purplish, with a thin fleshy epicarp, nut very hard, 3-angled, indehiscent, 1-celled by abortion of the other two; the almond consists of a membranous testa, enclosing the oily cotyledons, which are divided into three lobes, folded and twisted together. The kernels yield 40 per cent. of a semi-solid fat of an agreeable and sweet taste, which keeps very long without turning rancid. (*Brannt.*)

C. bengalense, *Roxb.*, a native of Sylhet and the adjoining districts, is described by Roxburgh as an immense forest tree. "From fissures or wounds in the bark a large quantity of very clear amber-coloured resin exudes, which soon becomes hard and brittle, and is then not unlike copal; yet the natives set little or no value upon it. In the Calcutta bazar

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it is only valued at from 2 to 3 rupees for 7 maunds of 80 lbs. weight each." (*Flora Indica.*) The resin is not now known in Calcutta, but Dr. King informs us that it is still sold in Darjeeling under the name of *Gokal-dhup*, the Paharia name of the tree, and is used by the Lepchas to burn as incense.

Cancamum.—Fée suggests that the κάγκαμον or κάγκαλον of the Greeks was probably a gum resin obtained from a plant belonging to this order, and Sprengel suggests that it may have been the resin of a Gardenia.

If we refer to Dioscorides we find that he speaks of it as an Arabian gum, something like myrrh in appearance, used for fumigation on account of its fragrance, and administered medicinally to reduce corpulence and to cure spleen, &c., and also as an emmenagogue; it was applied locally to remove opacities of the cornea and improve the sight, also to cure toothache; acording to Paulus Ægineta it was considered to be laxative.

We think there can be no doubt that this substance was the *Kankahar*, *Kaikahan*, or *Kaighaman* of the Arabians, a kind of Rosin which they describe as having exactly the same properties as those attributed to Cancamum by Dioscorides. Haji Zein the druggist (A.D. 1368) describes it as having the appearance of Copal, and the Indian Mahometan writers on Materia Medica identify it with the Rála or Dhuna of India, which is *Shorea resin*, and which is used throughout the East as incense. Pliny (12, 44) mentions Cancamum and Tarum (Aloe wood) as coming from the country which produces cinnamom and cassia, and brought to Europe by the Nabatæan Troglodytæ, a colony of the Nabatæi.

MELIACEÆ.

MELIA AZADIRACHTA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 62; *Wight Ic.*, *t.* 17. Indian Lilac (*Eng.*), Azadirac d'Inde (*Fr.*).

Hab.—India. The bark, root, leaves, flowers, fruit, gum, and oil of the seeds.

Vernacular.—Nimb (*Hind.*), Nim (*Beng.*), Nimb, Bálata-nimb (*Mar.*), Bevina-mara, Isa-bevu (*Can.*), Nimbamu, Vepachetta (*Tel.*), Vembu, Veppam (*Tam.*), Limbado (*Guz.*).

History, Uses, &c.—This tree, in Sanskrit Nimba and Arishta, is a native of India, and is cultivated in all parts of the country on account of its medicinal properties. The leaves, bark and other products of the Neem have been articles of the Hindu Materia Medica from a very remote period, and are mentioned in the Ayurvedas of Susruta. The bark is considered to be bitter, tonic, and astringent. The leaves are added to poultices to disperse glandular tumours, and are used generally as a discutient; beaten into a pulp they are applied to pustular eruptions, more especially to the eruption of smallpox; their juice is anthelmintic, and is given in a variety of diseases, such as jaundice, prurigo, boils, &c. Chakradatta recommends a poultice of the leaves mixed with Sesamum seeds for unhealthy ulcerations. The fruit is described as purgative, emollient, and anthelmintic. The oil of the seeds is applied to suppurating scrofulous glands, is given in leprosy, rheumatism, and a variety of diseases. It is vermifuge, and is a remedy for mange in dogs. It has been used in the manufacture of soap. As the oil contains a marked amount of sulphur, *neem oil soap* might possibly be useful in cutaneous affections in which a mild sulphuretted application is indicated. The beneficial effects of the oil when rubbed into the skin in rheumatism is doubtless due to the presence of organically combined sulphur. The gum is said to have stimulant properties. The young trees tapped yield a saccharine juice, which when fermented is used as a stomachic; several observers have noticed that in certain years this juice appears to flow with unusual abundance.

The dried flowers are used as a tonic after fever, and under the name of *Pancha-nimba,* a medicine is prepared which contains the flowers, fruit, leaves, bark, and root of the tree, of each 15 parts, and one part each of a number of other drugs. The nimba is also one of the *Pancha-tikta* or five bitters.

The air waved with a Neem branch is supposed to be a cure for syphilis. The insane are passed through a cleft of the tree, or a stem which having parted and re-united forms a circular opening. Buchanan, in his "Journey through Mysore," relates that—"Once in two or three years the Coramás of a village make a collection among themselves, and purchase a brass pot, in which they put five branches of *Melia Azadirachta* and a cocoanut. This is covered with flowers and sprinkled with sandalwood water. It is kept in a small temporary shed for three days, during which time the people feast and drink, sacrificing lambs and fowls to Marima, the daughter of Siva; at the end of the three days they throw the pot into the water." This practice is known in other parts of India as घटस्थापन (Ghatasthapan), and is considered to avert ill luck and disease. Amongst certain castes the leaves of the Neem are placed in the mouth on their return from funerals as an emblem of grief. Five to eight leaves are eaten by all Hindus on the first day of the New Year, and are supposed to ensure freedom from disease; when amrita (ambrosia) was being conveyed to heaven from the lower world for the use of the gods, it is believed that a few drops of it fell on this tree. For an account of the mythology of amrita, *see* De Gubernatis, Myth. des Plantes I., p. 32.

This useful tree naturally attracted the attention of the Mahometans upon their arrival in the country, and they named it Azaddarakht-i-Hindi, from its resemblance to the *Melia Azedarach* or Persian Lilac. The author of the Makzan-el-Adwiya is careful to point out that the Indian Neem is not found in Persia. He describes the Neem and Azadarakht separately, giving Bakayan as the Indian name for the latter. The Mahometans use the different products of the Neem in the same manner as the Hindus, and like them consider it to be cold and dry. Amongst European physicians, Wight says, "The leaves beaten to a pulp, and externally applied, act like a charm in removing the most intractable forms of psora and other pustular eruptions." Dr. White, of Bombay, has recommended the bark as a febrifuge; others have spoken

favourably of the leaves as a local application to ulcers and certain obstinate skin diseases. Dr. Hové (1787) thus speaks of the Neem tree:—"The Gentoos here worship this tree, and their barren women invoke and perform the same ceremonies round it every morning as they usually do in the other Pergunnahs about the *Ficus religiosa*. The leaves are of a powerful bitter, and they use a strong decoction with great success in intermittents, and which I usually drank for my liver complaint and found myself much relieved by it." He also notices the use of the gum by lying-in women.—(*Hové, account of Mitampoor.*) From recent experience detailed in the Pharmacopœia of India, it would appear that the opinion of the natives of India regarding the medicinal properties of the different parts of this tree is substantially correct. The bark is now official in the abovementioned Pharmacopœia.

Description.—Neem bark is coarsely fibrous; it varies much in thickness according to the age of the tree from which it is taken. The external surface is rough, fissured, and of a rusty grey colour; the inner surface yellowish and foliaceous. The taste is bitter and astringent. The leaves are simply pinnate, leaflets 9 to 15, ovate, lanceolate, unequal sided, acuminated, serrated, 1 to 3 by ½ to 1½ inches, very bitter. The fruit when ripe is purple, 1-celled, 1-seeded, ½ to ¾ in. long; within the fleshy portion is a thin hard woody shell, which encloses an oily bitter kernel like a small filbert, greenish white, with a brown testa. The dried fruit resembles a small raisin, the inner portion of the pulp is adherent to the stone, and fibrous from the presence of very large liber cells. The expressed oil is of a pale yellow colour and bitter taste. It has a powerful garlic-like odour. The gum is yellowish, like inferior gum Arabic, generally in longish vermiform pieces, not bitter, and freely soluble in cold water. It is unaffected by neutral acetate of lead, gives a curdy white precipitate with basic acetate, a reddish gelatinous precipitate with ferric chloride, is unaffected by borax, is slightly reduced by boiling with Fehling's solution, which it turns of a dull red colour. Iodine does not

affect it, but it precipitates with oxalate of ammonia. It makes a weak mucilage, and is of little value.

Microscopic structure.—According to the *Pharmacographia*, the suberous coat consists of numerous layers of ordinary cork cells, which cover a layer of nearly cubic sclerenchymatous cells. This latter, however, is not always met with, secondary bands of cork (rhytidoma) frequently taking its place. The liber is commonly built up of strong fibre-bundles traversed by narrow medullary rays, and transversely separated by bands of parenchymatous liber tissue. Crystals of oxalate of calcium occur in the parenchyme more frequently than the small globular starch grains. The structure of the bark varies considerably according to the gradual development of the secondary cork bands. We have examined the fresh bark and find that it agrees with this description.

Chemical composition.—An infusion of the bark gives with perchloride of iron a blackish precipitate; the infusion is not altered by tannic acid or iodo-hydrargyrate of potassium. If the inner layers of the bark are alone exhausted with water, the liquid affords an abundant precipitate with tannic acid; but if the entire bark is boiled in water, the tannic matter which it contains will form an insoluble compound with the bitter principle and prevent the latter being dissolved. (*Pharmacographia.*) According to Broughton, the bitter principle of the bark is a neutral resin, having scarcely any definite reactions. It may be obtained by exhausting the bark with alcohol of 60 per cent., precipitating the filtered tincture with water, and purifying the precipitate by solution successively in benzene, carbon bisulphide, dry ether, and finally, absolute alcohol. It is soluble in strong boiling solutions of the fixed alkalies, from which acids precipitate it apparently unaltered. It does not form definite compounds with acids or with bases, but on treating it with nitric acid and precipitating with water, a nitro-derivative is obtained, having the composition $C^{38} H^{46} (NO^2)^4 O^{11}$, hence the formula of the bitter principle is inferred to be $C^{36} H^{50} O^{11}$.

The leaves contain a small quantity of a bitter substance of a similar character but much more soluble in water. This substance, also contained in the bark, is a hydrate of the resin, which it closely resembles in its properties.—(*Pharm. Journ.*, (3), iii. 992.)

Margosa or Neem oil extracted from the seeds and examined by Warden had a specific gravity of ·9235 at 15·5° C.; at about 10°—7° C. it congealed without losing its transparency. After standing for about 36 hours the recently expressed oil deposited a white sediment, which examined microscopically was found to be amorphous. The colour reactions of margosa oil were not characteristic. With concentrated sulphuric acid a rich brown colour was yielded, and a strong garlic odour evolved. By Massie's test with nitric acid the oil became almost immediately of a reddish colour; after standing about one hour and thirty minutes the colour was pale yellow. The elaidin reaction conducted according to Poutet's directions yielded a solid firm yellowish product after eighteen hours, the temperature in the laboratory varying between 89° and 93° F. Exposed in a thin layer on a glass plate to a temperature of 100° C. for some days the oil did not dry or become tacky. The oil was easily soluble in ether; chloroform, carbon bisulphide, benzole, &c. Absolute alcohol agitated with it was coloured greenish; on separating the alcohol, and evaporating off the spirit, an extract was obtained which consisted of oil, from which a small residue, whitish in colour, separated on standing. The alcoholic extract was very bitter, and possessed in a marked degree the peculiar odour of the oil. The whitish residue deposited from the oil separated by alcohol, and examined microscopically, did not appear crystalline. Margosa oil after repeated agitation with alcohol was found to have lost its bitterness and almost wholly its alliaceous odour.

A known weight of the oil was saponified with alcoholic potash, the alcohol completely evaporated off, and the soap dissolved in water. On agitating the aqueous solution of the soap with ether, 1·60 per cent. of ether extract was obtained of an orange-

yellow colour and bitter. This extract, treated with 60 per cent. alcohol, left a small amount of white residue, which had the character of a wax. The aqueous solution of the soap, after separation of the ether, was heated for some time to remove dissolved ether, the solution was then mixed with dilute sulphuric acid in excess, and the insoluble separated from the soluble fat acids in the manner recommended by Allen.* The soluble fatty acids amounted to 3·519 per cent., the insoluble to 89·128 per cent. The volatile acids consisted of butyric and a trace of valeric acid. During the distillation to separate the fluid from the volatile fatty acids, a small amount of a snow white fatty acid passed over; this acid had a melting point of 43·6° C., which corresponds with the fusing point of lauric acid. A weighed portion of the insoluble fatty acids, from which the lauric acid had not been separated, was dissolved in alcohol, and titrated with normal standard soda, using phenolphthalein as an indicator, ·288 gram of the acids required 1 c.c. of caustic soda for neutralization. No attempt at separating the fixed fatty acids was made; they probably consisted of a mixture of stearic and oleic acids, with a small amount of lauric acid.

Examined by Reichert's distillation process, 2·5 grams of the oil gave a distillate which after separation of the lauric acid, which had distilled over, required 4·6 c.c. of decinormal soda for neutralization, phenolphthalein being used as an indicator.

The saponification equivalent of the oil was determined by Koettstorfer's method, and was equal to 284, the percentage of caustic potash required to saponify the oil being 19·72.

A preliminary examination of the oil having indicated the presence of sulphur, a quantitative estimation of the amount present was made and found equal to ·427 per cent. The oil after repeated agitation with alcohol was found to contain only ·109 per cent. of sulphur.

The extract obtained by agitating the oil with absolute alcohol has already been referred to; it was examined in the following manner:—The oily extract was treated with 60 per cent. spirit,

* 'Commercial Organic Analysis.'

allowed to stand, and the clear yellow alcoholic solution decanted from the insoluble oil; the alcoholic solution thus obtained was evaporated to dryness, mixed with ammonia, and agitated with ether. The ether solution was marked *A*. The aqueous solution, after separation of the ether, was mixed with dilute hydrochloric acid, and again agitated with ether. The ether separated of a yellow colour, and below it some flocks of a dirty yellow hue, which refused to dissolve after prolonged agitation. The ether solution was marked *B*. From the aqueous solution the insoluble flocks were separated by filtration and marked *C*. The filtrate was not further examined.

Examination of ether solution A.—The solution was agitated with dilute hydrochloric acid, to remove any principles of an alkaloidal nature. The ether was then separated and evaporated; the resulting extract was pale amber in colour, viscid at first, very bitter, and had a marked odour of the oil. It contained sulphur. It was easily soluble in 60 per cent. alcohol, ether, chloroform, &c., but insoluble in acids, or in caustic alkaline solutions. It had the properties of a neutral resin.

The hydrochloric acid solution was of a yellow colour; it was mixed with ammonia, which occasioned a white precipitate, and agitated with ether. The ethereal solution on evaporation left a yellow residue, not readily soluble in dilute acids. The dilute sulphuric acid solution was bitter, and yielded a precipitate with alkaline carbonates and hydrates, phosphomolybdic, and picric acids, potassio-mercuric iodide, chloride of gold and perchloride of platinum. This principle had therefore the properties of an alkaloid.

Ether solution B.—On evaporating the ether solution *B*, a dark reddish bitter extract was obtained, soluble in alkaline solutions, and re-precipitated in yellowish flocks by dilute acids. It had the properties of an acid resin

Precipitate C.—The precipitate was well washed, and dissolved in alcohol; on evaporation a brittle darkish residue was obtained, soluble in alkaline solutions, re-precipitated in yellowish flocks by acids, soluble with very great difficulty in ether,

easily soluble in chloroform. This principle thus also had the properties of an acid resin.

In addition to the principles above described as being present in the oil, an examination of the cake left after expression of the oil, indicated the presence of another neutral principle, insoluble in ether or alkaline solutions, but dissolving in chloroform.—(*Pharm. Journ.*, 1888.)

According to Brannt the seeds contain from 40 to 45 per cent. of oil.

Margosa cake is used as a manure in planting districts in Southern India. Two samples had the following composition:

	1	2
Moisture	6·08	9 93
Organic matter	84·50	83·15
Ash	9·42	6·92
	100·00	100·00
Nitrogen	5·07	5·41
Phosphoric anhydride	1·40	1·33

The powdered cake, like linseed meal, makes a very useful luting in chemical and physical laboratories, and is not liable to the attack of insects.

MELIA AZEDARACH, *Linn.*

Fig.—*Wight, Ic. t.* 160; *Bot. Mag., t.* 1066. Persian Lilac, (*Eng.*), Azédarac commun (*Fr.*).

Hab.—Himalaya, Persia. Cultivated elsewhere. The root-bark, fruit, flowers and leaves.

Vernacular.—Bakayan (*Hind.*), Bakána-nimb, Vilayati-nimb (*Mar.*), Malaivembu, Malai-veppam (*Tam., Mal.*), Bettada-bevina (*Can.*), Drek (*Punj.*), Konda-vepa, Turaka-vepa (*Tel.*), Ghora-nim (*Beng.*).

History, Uses, &c.—The Persian Lilac was probably introduced into the southern parts of India by the Mahometans. Haji Zein says that in Tabristan it is called Takhak, and in Shi-

raz Taghak, both corruptions of Ták, its proper Persian name. It is a native of the sub-Himalayan tracts, and is called in Sanskrit Mahanímba and Himadruma. The Hindus do not appear to have paid much attention to it, but it has been described by Ibn Sina in his second book under the name of Azaddarakht, and has long been used by the Arabs and Persians, who consider it to be hot and dry, and to have deobstruent, resolvent, and alexipharmic properties. The flowers and leaves are applied as a poultice to relieve nervous headaches. The juice of the leaves administered internally is said to be anthelmintic, antilithic, diuretic, and emmenagogue, and is thought to resolve cold swellings, and expel the humours which give rise to them. The bark and leaves are used internally and externally in leprosy and scrofula. A poultice of the flowers is said to kill lice and cure eruptions of the scalp. The fruit has poisonous properties, but nevertheless is prescribed in leprosy and scrofula, and is worn as a necklace to avert contagious diseases. In China it is used as a vermifuge.

Loureiro states that the Chinese boil the berries in wine and then make a decoction of them, which has no injurious effects. The leaves and bark they use in itch and other skin diseases.

The root-bark of *M. azedarach* is placed in the secondary list of the United States Pharmacopœia as an anthelmintic. It has a bitter, nauseous taste, and yields its virtues to boiling water. It is administered in the form of decoction (4 ozs. of the fresh bark to 2 pints of water, boiled to one pint), of which the dose for a child is a tablespoonful every third hour until it sensibly affects the bowels or stomach, or a dose may be given morning and evening for several days and then be followed by a cathartic.

Toxicology.—In large doses it produces narcotism followed by death. Dr. Burton Brown (*Punjab Poisons*) records a case in which a European girl ate the berries, became insensible and died. Descourtilz says that 6 to 8 seeds cause nausea, spasm, and choleraic symptoms, sometimes followed by death.

Description.—The fresh root-bark is thick and rather spongy, the external surface scabrous and warty, of a dark

brown colour; beneath the suberous layer it is of a deep pink; the inner surface is white; taste acrid, nauseous, astringent, and slightly bitter. The tree yields a soluble gum very similar to that obtained from the Neem.

Chemical composition.—J. Jacobs has found the active principle to be a light yellow, non-crystalline bitter resinous substance without alkaloidal properties. Sugar is present and tannin occurs in the outer portion of the bark. The activity resides in the liber, and this alone is recommended to be used for medicinal preparations. (*Pharm. Journ., 27th September* 1879.)

MELIA DUBIA, *Cav.*

Fig.—*Beddome, Fl. Sylv. t.* 12.

Hab.—E. and W. Peninsulas, Burma, Ceylon. The fruit.

Vernacular.—Dinkarling (*Hind.*), Kadu Khajur (*Guz.*), Nimbara (*Mar.*), Kád-bevu, Ara-bevu (*Can.*).

Description, Uses, &c.—The dried fruit of this tree is supposed to be the Arangaka of Sanskrit writers. In size, shape, and colour it is very much like a date, but upon closer examination the pulp is found to adhere firmly to a large and very hard stone. The remains of the peduncle may also be seen to be different from that of a date. When soaked in water the fruit soon loses its shrivelled appearance and becomes like an oval yellowish-green plum. The skin is now seen to be thick and easily separated from the pulp, which consists of a delicate parenchyme supported by fibrous bands attached to the stone. The apex of the fruit is blunt, and studded with small tubercles. At the base is attached the five-partite calyx, and a small portion of the fruit stalk. The stone is an inch in length, obscurely five-furrowed, oblong, perforated at both ends; apex 5-toothed round the perforation, 5-celled, or less from abortion; seeds solitary, lanceolar, attached from the apex; perisperm in small quantity; embryo straight, inverse; cotyledons lanceolate; radicle

oval, superior. The seed is $\frac{3}{4}$ of an inch long and $\frac{5}{6}$ broad; testa dark-brown or black, polished, kernel very oily, sweet-tasted. The pulp of the fruit has a bitter nauseous taste. It is a favourite remedy amongst the labouring classes for colic, half a fruit being the dose for an adult. It appears to have hardly any purgative properties, but is said to relieve the pain most effectively, and to act as an anthelmintic. In the Concan the juice of the green fruit with a third of its weight of sulphur and an equal quantity of curds heated together in a copper pot is used as an application to scabies, and to sores infested with maggots.

Chemical composition.—The bitter principle of the fruit is a white crystallizable glucoside soluble in ether, alcohol and water; it is precipitable from its aqueous solution by tannin and alkaloidal reagents but not by plumbic acetate, and it has a slight acid reaction. Sulphuric acid dissolves it with a deepening of colour, discharged on the addition of water. Boiled with diluted hydrochloric acid it is decomposed in less than half an hour into glucose and a colouring matter. Petroleum ether removes a fatty oil of nauseous property, and ether dissolves a tasteless wax of greenish colour soluble in boiling alcohol and only slightly in petroleum ether; besides these constituents, malic acid, glucose, mucilage and pectin occur in the fruit.

Commerce.—The fruits are sold in the bazar at Re. 1-4 per lb.

NAREGAMIA ALATA, *W. & A.*

Fig.—*Rheede, Hort. Mal. x., t.* 22; *Wight Ic. t.* 90.

Hab.—W. Peninsula. The stem and roots.

Vernacular.—Pittvel, Pittpápra, Pittmári, Tinpáni (*Mar.*), Nela-naregam (*Mal.*), Nela-naringu, Nalakanu-gida (*Can.*), Trifolio (*Goa.*)

History, Uses, &c.—This is the country Ipecacuanha of the Portuguese at Goa. Garcia d'Orta, who calls it *Avacari*

(ओकारी = emetic), mentions a wonderful cure of a case of dysentery treated by a decoction of the bark in rice water, but he appears never to have seen the plant, as he says:—" Esta raiz desta matta dizem que cheira a trevo." (*Coll.* 27.)* The Goanese name Trifolio appears to be a translation of the Marathi Tinpáni. It has a somewhat pungent, aromatic odour, but hardly any taste, and is given as an emetic in doses of from 12 to 18 grains. In Southern India it is used as a remedy for rheumatism and itch. (*Rheede.*) In the Concan the Hindus use the leaves and stems in decoction with bitters and aromatics as a remedy for biliousness. Naregamia has recently been tried in Madras in acute dysentery, and also as an emetic and expectorant with results similar to those obtained from Ipecacuanha given in equal doses. The forms for administration are the powder and tincture (2½ ozs. to 1 pint of rectified spirit). It has been used with good result at the General Hospital at Vienna in the form of a fluid extract which is of a bright golden-brown colour, and has an odour recalling that of *Valeriana celtica*; when the extract is diluted with water it becomes turbid and milky, and on the addition of more water opalescent. The dose of this preparation is from 3 to 5 grams in 20 grams of distilled water or aqua laurocerasi.—(*E. Ghillang. Ztschr. d. All Œst. Ap. Ver.* 1889, *p.* 279.)

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* Garcia's account of this drug is as follows:—

" Ha tambem nesta ilha uma arvore pequena, e porém de maior quantidade que esta outra frutice; tem as folhas e a flor como a *murta* (myrtle) e dá a fructa como *murtinhos* (myrtleberries), e do mesmo sabor e mais estiticos, e chamam esta herva *avacari*. Esta, me dice um Portuguez velho de muito tempo nesta terra, que mora no monte em uma sua quinta, que aproveita muito para camaras (dysentery) antigas de cauza fria; e que teve, por espaço de um anno, uma filha enferma de camaras, e que as outras mezinhas lhe não aproveitavam, e com esta fór restituida a saude; e perguntei-lhe quem lhe dicera que esta planta era boa pera camaras, e dice que um destes physicos da terra lhe dava a corteza pisada, e lançada em aqua d'arroz, feita a modo de tizana, que e o modo que tem no hospital de curar. Esta raiz desta mata dizem que cheira a trevo: e perguntei aos physicos desta terra por ella, e diceram me que era boa pera camaras, e que a misturavam com outra herva chamada *Coru* (*Holarrhena antidysenterica*) e que é muito boa misturada. Isto é o que sei destas mizinhas, e eu vos levarei a ver enfermos que curam os Malavares e os Canarins, e sabereis melhor tudo."

Description.—It is small woody shrub which grows on the banks of water-courses in shady places, seldom more than 6 to 8 inches high, consisting of several slender stems, sparingly branched, and rising from a spreading rootstock, which is contorted, knotty and warty. The leaves are alternate, mostly situated at the ends of the branches, and consist of a narrow winged petiole, ¾—1 inch long, at the end of which are articulated three small cuneate-obovate leaflets. The ends of the shoots and buds are seen under the microscope to be thickly covered with white simple hairs; the petiole and leaflets are nearly free from them. The flowers are large and white on axillary peduncles; the capsules 3-angled and 3-valved. The drug consists of the creeping root with the slender stems attached to it, the leaves having been stripped off.

Microscopic structure.—A section of the root presents a tolerably thick dry suberous layer of a brown colour; immediately within this, the parenchyma, which is composed of thin walled cells, is much loaded with a yellowish oil. In the inner portion of the bark the cells contain starch; the wood is very hard and of a greenish yellow colour.

Chemical composition.—The drug has been examined by Hooper (*Pharm. Journ.* [3], xviii. 317), who found that the ether extract contained an *alkaloid*, *an oxidizable fixed oil* and a *wax*. The alkaloid was separated by agitating the extract with diluted sulphuric acid, and the clear colourless solution at once afforded precipitates by the usual reagents. The alkaloid was left as an amorphous, slightly coloured residue of a brittle consistence, on the gentle evaporation of its ethereal solution. It formed crystalline salts with sulphuric, nitric and hydrochloric acids, but gave no satisfactory colour reactions when mixed with the concentrated acids. It was precipitated from its solutions by tannin, potassio-mercuric iodide, phosphomolybdate of soda, and iodine. It differs from emetine in readily forming acicular crystals with acids, and by not giving any colour with chlorinated lime and acetic acid; and it differs

from the principal cinchona alkaloids by its optical inactivity. Hooper proposes to call the alkaloid *Naregamine*. The fixed oil was soluble in strong spirit, also in dilute caustic soda with a brown and red fluorescent solution. The *wax* was insoluble in spirit; it was coloured brown and afterwards black by sulphuric acid. The alcoholic extract consisted mainly of *sugar* with some little resinous matter. No tannic substances were detected, but a body precipitable by neutral plumbic acetate, related to an organic acid. The aqueous extract evaporated to a small bulk, and treated with two volumes of alcohol, gave a precipitate of gum. The filtrate from this evaporated and treated with four volumes of alcohol, caused a precipitate which after standing some hours separated out into large colourless rhombic prisms, probably *asparagin*. Among the less important constituents of Naregamia are albuminous, pectinous, and colouring matters, starch, cellulose, woody fibre and ash. The starch is in minute rounded granules of about the same size as rice-starch. The ash is of a reddish colour, and ten per cent. of it is insoluble in hydrochloric acid. The following is the result of the analysis:—Ether extract 2·93, alcoholic extract 5·40, aqueous extract 7·00, albuminous matter, &c., 7·61, starch and cellulose 17·66, woody fibre 4·77, ash 5·52, moisture 9·11—total 100·00.

Commerce.—The drug is collected and supplied by Messrs. Hinde and Co., Calicut.

SOYMIDA FEBRIFUGA, *Juss.*

Fig.—*Bentl. & Trim., t.* 63. Redwood tree (*Eng.*).

Hab.—N. W., Central and S. India, Ceylon. The bark.

Vernacular.—Rohan or Rohán (*Hind., Beng.*), Shemmaram *Tam.*), Cheve-mánu, Somida-mánu (*Tel.*).

History, Uses, &c.—The astringent and febrifuge properties of this bark are known to both Hindus and Mahometans, and notices of it are to be found in some of their books on Materia Medica under the name of Rohan.

Roxburgh was the first to introduce it to the notice of Europeans as a substitute for the Peruvian bark. Ainslie describes it and says, "given to the extent of four or five drachms in the twenty-four hours I have found it to be a useful medicine, but beyond that quantity, it, in every instance in which I tried it, appeared to me to derange the nervous system, occasioning vertigo and subsequent stupor." The authors of the Bengal Dispensatory thus summarize its properties:—"It seems to us to be exactly similar to the mahogany bark, useful where astringent tonics are applicable, but of very questionable efficacy as a true antiperiodic." In 1791, Roxburgh sent the bark to Edinburgh, where Duncan made it the subject of a thesis,* which led to its admission into the Edinburgh and Dublin Pharmacopœias. It appears never to have attracted much attention in England, but recently it has been made official in the Pharmacopœia of India as a useful astringent tonic.

Description.—Flückiger and Hanbury describe the bark from a young tree as occurring in straight or somewhat curved half tubular quills, an inch or more in diameter, and about 1-5th of an inch in thickness. Externally it is of a rusty grey or brown, with a smoothish surface, exhibiting no considerable furrows or cracks, but numerous small corky warts. These form little elliptic scars or rings, brown in the centre, and but slightly raised from the surface. The inner side and edges of the quills are of a bright reddish brown. A transverse section exhibits a thin outer layer coloured by chlorophyll, and a middle layer of a bright rusty hue, traversed by large medullary rays and darker wedge-shaped rays of liber. The latter has a fibrous fracture, that of the outer part of the bark being rather corky or foliaceous. The whole bark when comminuted is of a rusty colour, becoming reddish by exposure to air and moisture. It has a bitter astringent taste, with no distinctive odour. (*Pharmacographia.*) To this we may add that the old bark has a ragged dry suber, a quarter of an inch thick, and of a rusty

* Tentamen de Swietenia Soymida, Edin. 1794.

blackish brown colour, deeply fissured longitudinally, and minutely cracked transversely; the small corky warts described above are still visible here and there between the fissures. Old bark is generally in half quills, the total thickness being about half an inch; its colour is a rich red brown; its substance when soaked in water becomes very compact.

Microscopic structure.—The ring of liber is made up of alternate prosenchymatous and parenchymatous tissue. In the latter the larger cells are filled with mucilage, the others with starch. The prosenchymatous groups of the liber exhibit the peculiar form known as *hornbast*: it chiefly contains the tannic matter, besides stellate crystals of oxalate of calcium, which are distributed through the whole tissue of the bark. The corky coat consists of vaulted cells.

Chemical composition.—The bitter principle of the bark has been ascertained by Broughton to be a nearly colourless resinous substance, sparingly soluble in water, but more so in alcohol, ether or benzol. It does not appear to unite with acids or bases, and is less soluble in water containing them than in pure water. It has a very bitter taste, and refuses to crystallise either from benzol or ether. It contains no nitrogen. The bark is rich in tannic acid. The tree yields a gum which forms a good adhesive mucilage having a dextro-rotatory property with polarized light. It thickens immediately with ferric chloride, and gives no precipitate with neutral plumbic acetate. The ash amounts to 2·11 per cent.

Commerce.—The bark is not an article of commerce.

Barks of a similar character are yielded by—

Chloroxylon Swietenia, *DC., Wight Ill. i., t.* 56; *Bedd. Fl. Sylv.*, t. 11. Billu (*Tel.*), Haladarava, Bheriya (*Mar.*), Mududa, Vummaay, Kodavaporsh (*Tam.*), a native of the Western Peninsula and Ceylon, yields an astringent bark which is sometimes prescribed by Hindu physicians under the names of Raktarohida and Ragatrora, a name applied in India to several astringent barks. The suber of this bark is dark brown, and very rough from the presence of numerous elliptic

corky lenticels; it is very loosely attached, and when removed leaves a nearly smooth pale red surface. The tree also affords a soluble exudation allied to gum arabic, which occurs in amber-coloured tears, more or less cracked. It swells in water to a whitish and transparent jelly; with more water it becomes liquid enough to pass through a paper filter. The solution has a slight acid reaction, it is coagulated without colour by ferric salts, and is not precipitated by neutral plumbic acetate. The gum affords a calcareous ash amounting to 4·16 per cent.

The wood of this tree is the *Satinwood* of India; it is oily, and turns well, making nice stethescopes, &c.

Cedrela Toona, *Roxb. Cor. Pl. iii., t.* 238; *Bedd. Fl. Sylv. t.* 10. Tún (*Hind.*), Tuni (*Mar.*), Nandurike (*Can.*), Tunumaram (*Tam.*), and in Sanskrit Tunna and Nandivriksha, has a very astringent bark, which is used by native physicians in combination with Bonduc nuts as a tonic and antiperiodic. The flowers (*Gul-tun*), which are small, yellow, and sweet-scented, contain a yellow dye, and are considered to be emmenagogue. Nees von Essenbeck has published an account of some experiments made with the bark which indicate the presence in it of a resinous astringent matter, a brown astringent gum, and a gummy brown extractive matter, resembling ulmine. We find that the gum of this tree first swells, and then dissolves in water; the solution is unaffected by neutral plumbic acetate and ferric chloride, and is optically dextrogyrate. The gum leaves when burnt 4·68 per cent. of ash, consisting mainly of calcium carbonate. The wood resembles mahogany.

Chickrassia tabularis, *Adr. Juss. Wight Ill. i., t.* 56; *Bedd. Fl. Sylv. t.* 9, a tree of Eastern Bengal and of the Western Peninsula from the Concan to Travancore, has an astringent bark, without any bitterness, which is sometimes used as a febrifuge. The wood, which is close-grained and light-coloured, is known as *Chittagong wood*, or *White Cedar*, and is used by cabinet makers and coopers. The generic name of the tree is derived from the Bengali name *Chikrassi*; it is called in Tamil *Agil.*

WALSURA PISCIDIA, *Roxb.*

Fig.—*Wight Ill. i. t.* 55. *Syn.*—Trichilia trifoliata.

Hab.—W. Peninsula, Malabar, Travancore, Ceylon. The bark.

Vernacular.—Walsura (*Tam.*), Walurasi (*Tel.*).

History, Uses, &c.—Roxburgh records that the bark is used to stupefy fish in India, and that fish so caught are not considered unwholesome. Corre and Lejanne state that in the Antilles the tree is known as *Herbe à mauvaises gens* or *Herbe à méchants,* and that the bark acts as a dangerous emmenagogue and violent emetic.

Forskahl mentions a species (*Trichilia emetica*), called رقه (Rukeh) by the Arabs, the fruit of which is their Jauz-el-kai or emetic nut, and is used also in hair washes to kill lice, and made into an unguent, to cure itch. In India the Mahometans have adopted the fruit of *Randia dumetorum* as a substitute for the true Jauz-el-kai of the Arabs. (See *Randia.*)

Mr. Hollingsworth, Assistant to the Professor of Botany at the Medical College, Madras, has experimented with the bark off and on for about a year. He finds that it acts effectually as a fish poison, and he has eaten the fish killed with it and finds them quite wholesome. He says the bark is stimulant and expectorant, and thinks it must contain saponin.

Description.—The bark kindly supplied by Mr. Hollingsworth is about a quarter of an inch thick, and can easily be divided into a thick suber of a brown colour, very deeply and irregularly fissured in a longitudinal direction on the outer surface, with a tendency to separate in flakes; and an inner portion or liber of a light cinnamon colour, and very hard and compact. The taste is bitter and astringent, a transverse section of the bark magnified shows very numerous groups of stony cells arranged in rows at regular distances amongst the liber tissue.

Chemical composition.—The bark contains a resin anhydride in the alcoholic solution of the ether extract. It is light brown in colour, melting at about 80° C.; insoluble in water and in diluted acids and alkalies in the cold. Boiled with strong soda it is slowly dissolved. It is partly soluble in dilute sulphuric acid when boiled, and separates in lustrous scales on cooling. With strong sulphuric acid it dissolves with a deep red colour; this solution precipitates on the addition of water. It reduces Fehling's test, and its alcoholic solution is not affected by ferric chloride. Saponin is contained in the aqueous extract of the bark, and a large quantity of tannin, giving a greenish-black colour with ferric salts, is present in the extract obtained by spirit.

AMOORA ROHITUKA, *W. and A.*

Fig.—*Bedd. Fl. Syl. t.* 132; *Griff. Ic. iv., t.* 589, *f.* 3.

Hab.—Assam, Sylhet, Oudh, W. Peninsula. The bark.

Vernacular.—Harin-harra, Harin-khana, Sohaga (*Hind.*), Rohituk, Raktarohida (*Mar., Tam., Tel.*), Tikta-raj, Pitraj (*Beng.*), Amora-amari (*Assam.*), Mullamuttala-gida (*Can.*).

History, Uses, &c.—Hindu medical writers describe the properties of this tree, under the Sanskrit names of Rohituka, Rohini and Rohera, as aperient, and a remedy for enlarged glands, liver disease, spleen, and corpulence. It is considered to be of peculiar efficacy in enlargement of the spleen, hence it bears the synonyms of *Pliha-ghna,* "spleen destroyer," and *Pliha-shatru,* "enemy to spleen." *A. Rohituka* is an evergreen tree with large pinnate leaves and dull yellow or reddish fruit about 1½ inch in diameter, which are 3-celled and 3-valved, and usually contain three chestnut-coloured oblong seeds, enclosed in thick, fleshy, scarlet arils. Graham likens the fruit to a ball of Windsor soap. Roxburgh fully describes the tree under the name of *Andersonia Rohituka,* and states that where it is plentiful, the oil of the seeds is extracted for economical purposes. The bark appears to us to be a useful astringent.

Description.—Amoora bark is of a blackish-brown colour externally, and rough from the presence of numerous small, elliptic, warty projections, arranged longitudinally, and from minute fissures. Its substance is of a deep reddish-brown, and shows a striated internal surface; fracture short; when fresh it is soft and easily cut.

The bulk of the bark is composed of parenchyme cells, containing starch and colouring matter; there are numerous yellow stone cells arranged in broken concentric layers, and very little woody fibre. The bark has a very astringent taste and turns of a greenish black when touched with a solution of ferric chloride. It has no particular odour.

Chemical composition.—The bark contains two yellow resins soluble in ether, one of them insoluble in alcohol and alkaline solutions, the other soluble in such liquids and of an acid nature. The alcoholic extract contains both soluble and insoluble tannin, giving a dirty green reaction with ferric salts. A decoction of the bark gives a blue-black colour with iodine solution, showing the presence of abundance of starch, and the powder leaves 12 per cent. of mineral matter when burnt.

AGLAIA ROXBURGHIANA, *Miq.*

Fig.—*Wight Ic., t.* 166 ; *Bedd. Fl. Sylv., t.* 130.

Hab.—Western Peninsula, Ceylon.

Vernacular.—Priyangu (*Hind., Beng., Mar.*), Tottila-kayi (*Can.*).

History, Uses, &c.—This tree is the Priyangu of Sanskrit writers, and bears the following synonyms—Syáma, Kántatva, Nandini, Phalini, Lata ; which form a very poetical description and may be translated:— Like a slender maiden of golden complexion, elegant, graceful, a fruit-bearing tree, with drooping branches ; and a description the justness of which we have acknowledged by giving the name Aglaia (the bright one), one of the Graces, to the genus. The fruit is used in Hindu

medicine, and is considered to be cooling and astringent, and useful in inflammatory, bilious, and febrile complaints; it is also thought to be beneficial in leprosy. The seeds appear to be the part to which the medicinal reputation of the fruit is due.

Description.—A large tree with pinnate leaves, and yellow flowers. Fruit $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, sub-globose, very minutely pilose, 1 to 2 celled and seeded, buff-coloured when fresh, brown and wrinkled when dry. It consists of a thin shell inclosing 1 or 2 brown seeds, covered by a pink fleshy aril.

The seeds are flat, of somewhat irregular outline, with one side slightly convex; they are nearly half an inch in diameter and remarkably acid and astringent; when dry they have an aromatic odour.

Chemical composition.—The seeds deprived of their husks, dried at a low temperature and reduced to fine powder yielded 9·14 per cent. of moisture. The ash amounted to 2·91 per cent., and contained no manganese. With the exception of astringent matter which afforded the reactions for quercitannic acid, there is nothing special to note in connection with these seeds.

The bark of **Carapa moluccensis,** *Lam.*, the *Granatum littoreum* of Rumphius (iii., 92, t. 61), a tree of the muddy sea coasts of India and Ceylon, is bitter and astringent, and is employed by the Malays in colic, diarrhœa and other abdominal affections.

CELASTRINEÆ.

CELASTRUS PANICULATA, *Willd.*

Fig.—*Wight Ill.* 179, *t.* 72; *Ic. t.* 158.

Hab.—Hilly districts from Himalaya to Ceylon. The seed and oil.

Vernacular.—Málkanguni (*Hind., Guz., Mar., Can.*), Gundumeda, Malkanguni (*Tel.*), Valuluvai, Ati-parich-cham (*Tam.*).

History, Uses, &c.—The seeds have long been in repute with Hindu physicians on account of their acrid and stimulating

properties, and are called in Sanskrit Vanhiruchi, Kanguni, Katumbhi and Jyotishmati, the last synonym meaning "light-possessing," is an allusion to their supposed property of stimulating the intellectual powers (बुद्धि) and sharpening the memory (स्मृति). There is a treatise called *Jyotishmati Kalpa* in which is given the method of extracting the oil from the seeds, either by laying them on the blade of a sword and exposing them to the rays of the sun, or by the action of heat over the fire. This oil is used in the Courts and Colleges of India by a great many pundits to increase the intelligence of their pupils. The Mahometans recapitulate in their works on Materia Medica with some additions what the Hindus say about the drug.

The seeds are thought to be hot and dry, aphrodisiacal, and stimulant, useful both as an external and internal remedy in rheumatism, gout, paralysis, leprosy, and other disorders which are supposed to be caused by cold humours. They may be administered in such cases commencing with a dose of one seed to be gradually increased to fifty by daily increments of one, at the same time the oil may be applied externally, or the crushed seeds combined with aromatics. The latter application is said to be very efficient in removing local pains of a rheumatic or malarious nature. Another preparation for internal administration is made by placing the seeds with benzoin, cloves, nutmegs, and mace into a perforated earthen pot, and then obtaining by distillation into another pot into which it is fitted a black empyreumatic oil. This substance was brought to notice by Herklots as a remedy in Beri-beri under the name of *oleum nigrum*. In doses of from 10 to 15 drops twice a day it acts as a powerful stimulant, and generally produces free diaphoresis. In the Concan 4 tolás of the leaf-juice are given as an antidote in overdoses of opium, and the seeds made into a paste with cow's urine are applied to cure scabies.

Description.—The fruit is a 3-celled, globose green capsule, containing from 3 to 6 seeds enclosed in a complete arillus of a rich orange colour and sweet taste; the seeds are about the size of millet, of a reddish-brown colour, oily, and

angular like the section of a sphere; the testa is hard, and the kernel which is white has an acrid taste. The expressed oil (sometimes called staff tree oil) has a deep reddish-yellow colour, apparenty derived from the adhering arillus; it deposits a quantity of solid fat after it has been kept for a short time.

Chemical composition.—The powdered seeds exhausted with ether afford 30 per cent. of a thick reddish, bitter oil with aromatic odour. The bitter principle is insoluble both in cold and boiling water, but is readily extracted from the seeds with proof spirit. Ether extracts it together with the oil, and it may be separated by shaking the oil with 85 per cent. alcohol. The bitter principle is of a resinous nature, similar to a glucosidal resin. A small quantity of a tannin giving a greenish colour with ferric salts is present. The ash amounts to 5·8 per cent. of the seeds.

Commerce.—The seeds and expressed oil are always obtainable in the shops. Value, seeds, 2 as. per lb.; oil, Rs. 20 per cwt. The pomatum sold in the bazars under the name of *Maghas-shuddhi* (brain polisher) is probably composed chiefly of this oil.

ELÆODENDRON GLAUCUM, *Pers.*

Fig.—*Wight Ill.* 178, *t.* 71.

Hab.—Hotter parts of India and Ceylon. The bark and leaves.

Vernacular.—Bakra, Chauri, Jamrasi (*Hind.*), Támruj (*Mar.*), Nerija (*Tel.*), Chellupa-maram (*Tam.*).

History, Uses, &c.—According to Dr. Sakharam Arjun, the leaves are called *Bhutapála* by the Marathás, and are used as a fumigatory to rouse women from hysterical syncope, an affection supposed by the Hindus to be due to demoniacal possession. Dried and powdered the leaves act as a sternutatory, and are used to relieve headache. Roxburgh says:—"The fresh bark of the root, rubbed with plain water, is by the natives applied externally to remove almost every sort of swelling. It

is a very strong astringent, possessing scarcely any other sensible quality." In the Calcutta Exhibition Catalogue of 1883-84, it is stated that the root is a specific against snakebite, and the bark is used in native medicine and said to be a virulent poison. From experiments we have made there would appear to be no grounds whatever for the statement that the plant is poisonous: as stated by Roxburgh its most remarkable property is astringency.

Description.—Leaves opposite, sharp-petioled, oblong and cuneate-oblong, sometimes very acutely, and sometimes obtusely serrate; texture hard, with both surfaces polished, the upper shining; apex rather obtuse, and always bent down, from 3 to 4 inches long, and about 2 broad. The root bark is compact and brittle, and has a granular fracture; it occurs in small irregular fragments, is of a dull reddish colour, and is covered by a scabrous brittle suber, the external surface of which is brown or sometimes yellowish, and the substance and internal surface of a bright brick red. Some pieces of the bark show small warty prominences which are usually fissured exposing the brick red colour of the suber.

Both leaves and bark are astringent to the taste and slightly bitter. The microscope shows that the bark is loaded with large rhomboid crystals, which are chiefly deposited along the course of the vascular canals; the red colouring matter is mostly contained in separate cells, only a few stone cells are present, the friable nature of the bark is therefore due to the large crystalline deposit.

Chemical composition.—Elæodendron bark contains an alkaloid separable by lime and chloroform, which gives a purplish colour with sulphuric acid, and yellow with nitric acid. The alkaloid was in the bark in combination soluble in water, forming a crystalline salt when evaporated. Two resins were found, one soluble in ether and warm amylic alcohol, the other in rectified spirit. The bark afforded 8 per cent. of tannin, giving a dark green colour with ferric salts, and 5·25 per cent. of glucose. The air-dried bark had 6·98 per cent. of moisture, and gave as much as 18·15 per cent. of white ash when burnt.

More than four-fifths of the ash consist of calcium carbonate, mostly from the reduced calcium oxalate.

EUONYMUS CRENULATUS, *Wall.*

Fig.—*Wight, Ic. t.* 973; *Bedd., Fl. Sylv. t.* 144.

Hab.—Western Peninsula, Nilgiri hills.

EUONYMUS PENDULUS, *Wall.*

Hab.—Temperate Himalaya, East Bengal.

EUONYMUS TINGENS, *Wall.*

Hab.—Western Temperate Himalaya.

Vernacular.—Bárphali, Sikhi, Rangchúl, Guli, Pápar, Chopra, Kunku, Késari (*Hind.*). These names are applied indiscriminately to several Himalayan species.

History, Uses, &c.—The genus Euonymus consists of about forty species, most of which are natives of the tropical regions of Asia and the Malay Archipelago, but a few are scattered over Europe and America. A shrub called εὐώνυμος is mentioned by Theophrastus (*H. P.* 3; 18, 13), also by Pliny (13, 38); it was reputed to be poisonous, and to cause purging and vomiting. Matthiolus (*Valgr. V., i.,* 173, *f.*) identifies it with *Euonymus europæus*, and Gerarde calls the same plant *E. Theophrasti*. In English it is called Dogwood, Prickwood, Skewerwood, or Spindlewood; the French call it Fusain and the Germans Spindelbaum. The generic name, which in Greek signifies "of good repute," is applied to this genus by antiphrasis. The fruit of *E. europæus* is sometimes used in Europe to destroy lice. A drug called *Euonymin*, prepared by precipitating a concentrated tincture of the bark of *E. atropurpureus* with water, was first introduced by the Eclectic physicians of America. Griffith (*Med. Botany*) states that *E. americanus*, *E. europæus*, *E. atropurpureus* and several other species have similar properties, being all nauseous, purgative and emetic.

The numerous species of *Euonymus* which are common in the mountainous districts of India do not appear to be used as a purgative by the Hindus, neither does it appear that their medicinal properties have been investigated by European physicians resident in India.

According to Rutherford (*Phys. action of drugs on the secretion of Bile*, 1880, p. 45), 5 grains of Euonymin mixed with a small quantity of boiling water and placed in the duodenum of dogs, powerfully stimulated the liver; in these animals it only slightly increases the intestinal secretion, but in man it is an active purgative. Its action on dogs was found to be almost identical with that of podophyllin. The usual dose as a purgative is two grains at night, followed by a saline purge in the morning, which according to Rutherford should be sulphate of sodium.

The inner portion of the bark of *E. tingens* is of a fine yellow colour, and is used by the Hindus to make sectarial marks on the forehead. It is also used like *Mámirán* to subdue inflammation of the eyes. The wood of all the species is hard and close-grained, and is used for carving spoons and other small articles. The vernacular name *Kunku* refers to the colour of the arillus so remarkable in plants of this order. Kunku is the red substance used to make the small, round, red spot on the forehead, without which the toilet of a Hindu belle would be incomplete.

Description.—The bark of *E. crenulatus* is almost white, when fresh, but acquires a pinkish-brown colour on drying; the external surface is covered by a thin suber, and marked with numerous minute transverse lenticels; on the removal of the suber a chocolate-coloured surface is exposed, marked with similar lenticels of a pale colour. The bark breaks with a short fracture and has a close waxy texture; ferric chloride stains it dirty green. It is slightly astringent and not bitter. The outer surface of the bark from the larger branches of *E. pendulus* is grey and fissured in every direction; when this is removed an inner suberous coat of a bright yellow ochre colour is exposed. The woody inner bark is of a pale chocolate colour and of close waxy texture,

its inner surface is almost white when fresh, but when dry of a pale cinnamon colour. The taste is astringent; ferric chloride stains it a dirty green.

Chemical composition.—The tincture of the bark of *E. crenulatus* is of an olive-green colour, and produces a turbidity when poured into water. The tincture evaporated to dryness and treated with water, gives a soluble portion containing tannin, a sugar, but no alkaloidal body. It precipitates with ferric chloride dirty green, and with gelatine and plumbic acetate, but not with iodine or potassio-mercuric iodide. This extract evaporated to dryness affords white transparent rhombic crystals. The resinous portion insoluble in water is of a green colour, tasteless, and amorphous, soluble in ether, but imperfectly so in alkalies and alkaline carbonates. The aqueous solution contains gum, and when evaporated is highly crystalline, probably from the presence of mannite, or other saccharine substance.

The bark of *E. pendulus* is, in composition, very much like that of *E. crenulatus.* The young bark gives a green tincture with spirit and the older bark a red tincture; in each case on dissipating most of the alcohol and treating with water a greenish yellow resinous substance falls, and a bright red liquid remains. The resins are soluble in ether and partly in alkalies, and the red astringent supernatant liquor consists of tannin, giving a murky green colour with ferric chloride, and a quantity of saccharine matter. No bitterness was perceived in the extract, and nothing alkaloidal was detected. The aqueous extract of the drug, after exhaustion with spirit, contained a large quantity of a white, neutral crystalline body, which was dissolved by hot alcohol and crystallised out on cooling. The bark had no marked smell or taste, and afforded a light buff-coloured powder. The powder treated directly with rectified spirit gave 45·5 per cent. of extract, and when burnt left 12·8 per cent. of carbonated ash.

RHAMNEÆ.

ZIZYPHUS VULGARIS, *Lam.*

Fig.—*Sibth. Fl. Græc. I.* 159, *t.* 241. Jujube (*Eng.*), Jujubier (*Fr.*).

Hab.—N. India, Persia, China. The dried fruit.

Vernacular.—Unnáb (*Arab., Ind.*), Sinjid-i-jiláni (*Pers.*).

History, Uses, &c.—This is the Jujube of Arabic and Persian works on Materia Medica, and is largely imported in a dry state both from the Persian Gulf and China. Mir Mohammad Husain describes it as "the fruit of a well-known tree of nearly the same size as the kunár* and olive, but having leaves a little thicker and longer than those of the kunár, with one side downy. The bark, wood and fruit of the tree are red. The best fruit comes from Jurjan, China and Nipal; it should be sweet and moderately astringent, about the size of a dried date and with a small stone." He gives a long account of the medicinal virtues of the Jujube, from which we gather that he regards it as a suppurative, expectorant, and purifier of the blood. Pliny (15, 14,) mentions Zizyphus as an exotic fruit coming from Syria, more like a berry than an apple. Sibthorp informs us that it is called in modern Greek παλίουρί, and is probably the παλίουρος of Dioscorides.† The bark of the tree is used to clean wounds and sores, the gum in certain affections of the eyes, and the leaves when chewed are said to destroy the power of the tongue to appreciate the taste of disagreeable medicines. The French prepare a Pâté de jujubes by extracting 5 parts of jujubes in sufficient water to obtain 35 parts of infusion, in which are dissolved gum Arabic 30 parts and sugar 20 parts; the solution is evaporated, two parts of orange flower water added, kept slowly boiling for twelve hours, and then poured into moulds.

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* Kunar or Kinar, *Zizyphus Jujuba*, or wild Jujube, a generative tree of Persia from which the first spark of fire was obtained. (*Bundehesh, cap.* 15.)

† Dios. I., 106.

In India we have also several cultivated varieties of **Z. Jujuba** (*Sans.* Vadari or Badari, Dviparni and Vanakoli) which afford edible fruit, as well as a wild variety; their bark is powerfully astringent, and a kind of lac, known as *Bori-lák,* is found upon them. The fruit is dried and powdered; this powder is called in Hindi *Ber-chuni,* and is used as an article of diet. The young leaves are pounded with those of *Ficus glomerata,* and applied to scorpion stings; they are also with *Acacia Catechu* leaves given as a cooling medicine in hot weather in doses of two tolás (360 grains). According to Ainslie, the root is prescribed in decoction by the Vytians in conjunction with sundry warm seeds, as a drink in certain cases of fever.

The white pear-shaped fruit of **Z. rugosa** (Turan) is eaten by the natives, and the bark is used as an astringent in diarrhœa. The fruit of **Z. xylopyra** is used by shoe-makers for blackening leather and for making blacking. The flowers of **Z. rugosa,** with an equal quantity of the petioles of the Betel leaf, and half as much lime, are given in 4-grain pills twice a day for menorrhagia.

Description.—The dried fruit which comes from China is from 1 to 1½ inch long and ¾ inch broad; skin red, much shrivelled; pulp adherent to the stone, spongy, sweet and yellow; stone 7-10th inch long, very hard and rugose, apex sharp-pointed; shell very thick; seed oblong, flat, of a chestnut colour, 4-10th inch long and 2-10th broad. The fruit which comes from the Persian Gulf is somewhat smaller.

Chemical composition.—Jujubes contain mucilage and sugar. The bark and leaves contain tannin. The watery extract of the wood contains a crystallizable principle (ziziphic acid), a tannin (ziziphotannic acid) and a little sugar. (*Latour.*)

Commerce.—The Indian market is supplied from China and the Persian Gulf ports. The Chinese fruit is preferred, as it is larger and sweeter. Value, Chinese, Rs. 8 per Surat maund of 37½ lbs.; Arabian, Rs. 4—5.

RHAMNUS WIGHTII, *W. & A.*

Fig.—*Wight Ic., t.* 159.

Hab.—Western Peninsula, Concan to Nilgiris. The bark.

Vernacular.—Raktarohida, Ragatrora (*Mar.*).

History, Uses, &c.—We have not been able to identify this drug with any of those mentioned in native works on Materia Medica. The name Raktarohida or Raktrora, "red Rohita," appears properly to belong to *Amoora Rohituka,* but it is applied popularly to several astringent drugs. *R. Wightii* is a common shrub upon the highest hills of the Western ghauts, and extends to the Nilgiris and Ceylon; the leaves are glabrous, sub-opposite, elliptic, shortly acuminate, sharply serrate, and sub-coriaceous. Pedicels axillary, fascicled, much shorter than the petiole; calyx 5-cleft; petals cuneate-obovate; flowers greenish-yellow; styles 3—4, diverging; ovary 3—4, celled. Gibson states that the bark is in much repute on account of its tonic, astringent and deobstruent properties. (*Bombay Flora.*) A liquid extract of this bark has been given by Dr. J. North in half dram to two dram doses to a number of natives without experiencing either any astringent or aperient effect; the larger dose produced no nausea, and it appeared to have only some slight tonic action. It is brought to Bombay by herbalists and sold to the shopkeepers.

Description.—The dried bark occurs as single quills or in curved pieces from 2 to 3 millimetres in thickness. The outer surface is dull brown in colour, beset with numerous corky protuberances or lenticels opening longitudinally, and sometimes closely covered with whitish or greenish lichen. The younger bark is ashy-grey with fewer lenticels; the older bark presents a more rugged surface, due to the growth of cork and the occurrence of deep transverse cracks, and is much thicker. The outer surface of the middle layer is reddish-brown, and exhibits indentations and transverse markings corresponding with the warts and cracks of the exterior layer. The

inner layers consist of pale liber fibres running through a mass of cells containing yellowish-brown colouring matter of a waxy consistence. The inner surface is dark chocolate-brown, becoming almost black when kept for some weeks. The fracture is short externally, and tough and fibrous internally. A section touched with a drop of potash solution becomes intensely red, with ferric chloride dirty green, and with iodine solution black. The taste is astringent and bitter, but not unpleasant, a sweetish after-taste being left on the palate. The odour of the bark recalls that of tan.

Microscopic structure.—A microscopic examination shows that throughout the parenchyma, especially of the mesophlœum, there are a number of aggregate crystals, more plentiful in older specimens. The mesophlœum contains many thick-walled cells. The medullary rays and inner cellular layers are filled with starch granules. A yellow colouring matter, residing principally in the liber and cambium, becomes brilliantly red in contact with potash solution. In the cells surrounding the liber vessels, are numerous large rhomboidal crystals.

Chemical composition.—The bark has been examined by D. Hooper (*Pharm. Journ.*, Feb. 1888), with the following results:—

Crystalline principle	0·47
Light brown resin soluble in ether	0·85
Red resin soluble in ether	1·15
Red acid resin soluble in alcohol	4·56
Indifferent α—resin sol. in alcohol	3·80
Indifferent β—resin sol. in alcohol	1·64
Tannin	2·68
Bitter principle	1·23
Sugar reducing	2·20
Sugar non-reducing	10·12
Malic acid (?)	0·89
Cathartic acid	4·42
Extractive soluble in water	0·65
Albuminous matter	6·67
Modification of arabin sol. in alkali	1·75

Calcium oxalate	7·43
Starch	7·83
Modification of arabin sol. in acid	5·54
Cellulose	16·17
Suberin, &c.	6·38
Lignin	9·80
Ash (balance of)	3·39
Moisture and loss	0·38
	100·00

The ash gave the following analysis:—

Insoluble silica	1·48
Soluble silica	0·18
Iron and alumina	1·55
Lime	47·04
Magnesia	2·91
Carbonic anhydride	35·52
Phosphoric anhydride	1·78
Sulphuric anhydride	0·68
Chlorine	trace
Alkalies, &c., by difference	8·86
	100·00

Mr. Hooper remarks that the crystalline body found in the ethereal extract appeared under the microscope as white transparent prisms, and was sparingly soluble in water, ether, alcohol, and boiling bisulphide of carbon. When freed from adherent resin, it was not coloured by strong sulphuric acid or potash solution, the crystals melted and partly sublimed when heated, leaving a deposit of carbon. It had similar reactions with the "crystallizable body" obtained by Prescott from *Cascara Sagrada*. The light brown resin was soluble in rectified spirit, and gave a fine rose colour with diluted alkalies. When heated it melted to a reddish mass, and gave off greenish-yellow vapour, which sublimed and had similar characters to the original resin. It was semi-crystalline when observed under the microscope.

The red resin soluble in ether gave a fine purplish-red with alkalies, and was totally precipitated from solution by acids. It gave a crimson colour fading to a yellow, and dissolved in concentrated sulphuric acid. With nitric acid it became an orange-brown solution, and was precipitated on the addition of water. It was quite tasteless, and had no crystalline structure when evaporated from different solvents.

The red acid resin soluble in alcohol constituted the larger part of the resins present. It differed from the resins soluble in ether by its rapid decolorization and removal from solutions when shaken with animal charcoal. It is coloured deep red-brown with potash, and is at once thrown down when neutralized with acids.

The α-resin appears to be changed by heat and acids into the red resin soluble in alcohol. The β-resin is known by its insolubility in ammonia and fixed alkalies, but it affords red solutions with strong nitric and sulphuric acids. It has a brown colour which changes to green on exposure to the air. It resembles "the light yellow resin or natural body" found by Prescott in the bark of *Cascara Sagrada.*

VENTILAGO MADRASPATANA, *Gärtn.*

Fig.—*Wight Ic. t.* 163; *Gärtn. Fruct. I.* 223, *t.* 49, *f.* 2.

Hab.—Southern India, Ceylon, Burmá. The root bark.

Vernacular.—Khándvel, Lokhandi (*Mar.*), Vembádam (*Tam.*), Popli-chukai (*Can.*), Súrúghúndu-putta (*Tel.*).

History, Uses, &c.—Vembádam bark has long been used in Madras and Mysore as the source of a reddish brown dye, the tint of which is fixed by means of *kadukai* (chebulic myrobalans) and *paddicarum* (alum). Ainslie states that the powdered bark mixed with gingelly oil is sometimes used as an external application for the itch and other cutaneous eruptions. He gives Raktavalli, "red creeper," as the Sanskrit name.

The bark of the stem serves as cordage, and the natives of Amboyna make ropes of it. Buchanan frequently mentions

the dye under the name of *Popli,* and places it amongst the forest products of Mysore. (ii. 305.)

Description.—The Ventilago is a large scandent shrub, and reaches to the top of the highest trees in the forests where it grows. The leaves are ovate, acuminate, coriaceous and shining, and the flowers are in slender spikes. The fruit is samaroid, from 1½ to 2 inches long, and ⅜ inch broad; the nut is about the size of a pea, girt at the base by the remains of the calyx forming a disc. The roots are from ½ to 1 inch in diameter, and rough with reddish loose scales. The drug consists of the root bark in scales made up of numerous papyraceous layers of a deep reddish brown colour, and in some of the older pieces, with a metallic lustre. Vembádam bark gives up a red colour to water, and an intense reddish brown colour to rectified spirit; by being heated together the colouring matter is communicated to certain fats and fixed oils, and it is taken up by volatile oils even in the cold.

Chemical composition.—By treating the drug with water a liquor is obtained of red colour and slight acid reaction, giving violet red precipitates with lead acetate, calcium and barium hydrates, a rose-tinted lake with alum and potassium carbonate, and muddy mixtures with ferrous and ferric salts. The alcoholic solution is more acid in reaction, and does not precipitate with alcoholic lead acetate; the colour is removed from solution by means of animal charcoal, but not by heating with zinc dust. Evaporated carefully to dryness no crystals were observed, and the red mass re-dissolved in chloroform, benzol and carbon disulphide, and in alkaline solutions with a magenta hue, which was discharged by acids. This colouring matter is of an acid nature, and is probably one of the derivatives of anthracene.

Commerce.—Vembádam bark is collected extensively on the northern slopes of the Nilgiris In the Annual Report of the Madras Forest Department for 1887-88, it appears that 3 tons were collected, which realized a revenue of Rs. 62, the value of the permits. During the year 1888-89, 41 maund of 1st class

bark and 66 maunds of 2nd class bark were collected and sold by Government agency at Rs. 2 and Rs. 1-8 per maund respectively.

AMPELIDEÆ.

VITIS VINIFERA, *Linn.*

Fig.—*Bentl. & Trim.*, *t.* 66. The Vine (*Eng.*), Vigne cultivée (*Fr.*)

Hab.—N.-W. Himalayas. Cultivated elsewhere. Grapes and raisins.

Vernacular.—Augur, Dákh (*Hind.*), Drákh (*Guz.*), Dráksha (*Mar.*), Dirakhsha-pazhaṁ (*Tam.*), Dráksha-pandu (*Tel.*), Drakshi-hannu (*Can.*), Drákhyá (*Beng.*). Raisins, Kishmish, Munakha (*Pers.*, *Ind.*).

History, Uses, &c.—The cultivation of the Vine is of great antiquity. Noah planted a vineyard, and by drinking of the wine was made drunk. The wife of Jamshid tried to poison herself by drinking the juice of grapes, but the effects produced were such as to induce others to taste the poison. Hesiod gives directions for pruning the vine. According to Greek tradition, Dionysus taught all nations to cultivate the vine and to drink wine The Dionysus of the Greeks and the Indra of the Hindus are symbolical of the productive, overflowing, and intoxicating power of nature which often carries man away from his usual quiet and sober mode of living. The Soma of the Hindus and the original wine of Greek tradition was doubtless the celestial Amrita or Ambrosia. Grapes, in Sanskrit Draksha, are noticed by Susruta and Charaka; in the dried state they were used in medicine on account of their demulcent, laxative and cooling properties. It would also appear that a spirituous preparation was made from them, and was used as a stimulant under the name of Draksha arishta, the receipt for making which is as follows:—Raisins, 12½ lbs., water 256 lbs., boil together until reduced to one-fourth and

strain; then add, treacle 50 lbs., cinnamon, cardamoms, folia malabathri, flowers of *Mesua ferrea,* fruit of *Aglaia Roxburghiana,* black pepper, long pepper and seeds of *Embelia Ribes,* all in fine powder, of each 2¾ ozs., and set aside for fermentation. Grapes are described by Dioscorides under the name of σταφυλη; he also notices raisins (σταφὶς) and their medicinal properties.* Pliny speaks of *Uvæ,* grapes, and *Acini passi,* raisins.† The τρὺξ ὄινου of the Greeks, *Fæx vini* in Latin, is our Argol; the *Milh-el-tartír* of the Arabs. Mahometan writers consider grapes and raisins to be attenuant, suppurative and pectoral; the most digestible of fruit, purifying the blood and increasing its quantity and quality; they say that they are more wholesome if kept a few days after being gathered, and that the skin and stones should not be eaten. The ashes of the wood are recommended as a preventive of stone in the bladder, cold swellings of the testes, and piles; in the two last named diseases they are to be applied externally as well as given internally. The juice of unripe grapes, *Husrum* (Arab.), *Ghúreh* (Pers.), is used as an astringent; it is the ὀμφάκιον of Dioscorides, our Verjuice, and the *Agresto* of the modern Italians, who still use it in affections of the throat. The cut branches of the vine yield in spring an abundant sap, which was formerly used as a remedy for skin diseases, and is still a popular remedy in Europe for ophthalmia.

Extractum pampinorum vitis, which is used in some European countries as an astringent, diuretic, nervine and antispasmodic, and also to remove freckles, is made by evaporating the expressed juice of the young buds of the vine, exhausting the extract with alcohol, and again evaporating.

Grape marcs calcined in a closed vessel yield a fine black charcoal known as *Noir de Francfort.*

Different kinds of wine are used in medicine and pharmacy. The physiological action of wine upon the system is in some respects similar to that of alcohol, small doses being stimulant and large doses narcotic. Wine has also secondary medicinal

* Dios. V., 3.
† Plin. 14, 1, *et seq.*

effects which vary in different wines. Light white wines are diuretic, and red tonic and astringent. Taken in moderate quantity at meals, wine increases the heat of the body, aids nutrition, stimulates the functions of the different organs, and promotes the play of the imagination.

In making medicinal wines, a rich sweet wine should be used for the preservation of changeable drugs, red wines for tonic and astringent substances, and white wines for diuretic medicines. (*Dorvault.*)

Description.—The ovary of *Vitis vinifera* is 2-celled, with two ovules in each cell; it developes into a succulent, pedicellate berry of spherical or ovoid form, in which the cells are obliterated and some of the seeds generally abortive. As the fruit is not articulated with the rachis, or the rachis with the branch, it does not drop at maturity, but remains attached to the plant on which, provided there is sufficient solar heat, it gradually withers and dries: such fruits are called raisins of the sun. (*Hanbury.*)

Miscroscopic structure.—The outer layer or skin of the berry is made up of small tabular cells loaded with a reddish granular matter, which on addition of an alcoholic solution of perchloride of iron assumes a dingy green hue. The interior parenchyme exhibits large, thin walled, loose cells containing an abundance of crystals (bitartrate of potassium and sugar). There are also some fibro-vascular bundles traversing the tissue in no regular order. (*Pharmacographia.*)

Chemical composition.—From the *Pharmacographia* we gather that the pulp abounds in grape sugar and cream of tartar, each of which in old raisins may be found crystallised in nodular masses; it also contains gum and malic acid. The seeds afford 15 to 18 per cent. of a bland fixed oil, which is occasionally extracted, and which becomes thick at —15° C., and congeals to a brownish mass of the consistence of butter at about —16° to —18° C. On exposure to the air the oil remains smeary for some time, but finally dries. (*Brannt.*) Fitz has shown that it consists of the glycerides of erucic acid, $C^{22}H^{42}$

O^2, stearic acid and palmitic acid, the first named acid largely prevailing. The crystals of erucic acid melt at 34° C.; by means of fused potash they may be resolved into arachic acid, $C^{20} H^{40} O^2$, and acetic acid, $C^2 H^4 O^2$. The seeds further contain 5 to 6 per cent. of tannic acid, which also exists in the skin of the fruit. Wine is of a very complicated composition. In an old red wine, the following substances have been found in 1,000 parts:—Water 878, alcohol, containing traces of butyric and amylic alcohol, several aldehydes, and the *bouquet* composed of acetic, capric, caprylic, and œnanthic ethers, and essential oil 100. Sugar, mannite, glycerine, mucilage, gums, colouring matter or œnolin, fatty matter, nitrogenous matter or ferment, tannin, carbonic acid, acid tartrate of potash, tartrates, racemates, acetates, propionates, butyrates, lactates, citrates, malates, sulphates, nitrates, phosphates, silicates, chlorides, bromides, iodides, fluorides, meconates; potash, soda, lime, magnesia, alumina, oxide of iron, ammonia 22. Pasteur has recorded the presence in all wines of gum combined with phosphate of lime. (*Un. Pharm.*, 1869.) Ludwig that of trimethylamine, and Lebaigne the frequent presence of manganese (*Un. Pharm.*, 1870.)

G. Baumert has found that boric acid is contained in German, French, and Spanish wines, and in the leaves and tendrils of the grape vine. (*Ber.* 21, 3290.)

The aroma or *bouquet* of wines is due to certain essential oils, specially belonging to each kind; the vinous odour is due to an oil or ethereal principle which has been isolated by Liebig and Pelouze and named œnanthic ether. This oil, which exists only in small quantity, appears to be formed during fermentation Fauré thinks it is derived from the skin of the ripe fruit. Berthelot has isolated the bouquet by shaking the wine in a vessel of carbonic acid gas with ether freed from air by passing carbonic acid gas through it. The ether on evaporation in a current of carbonic acid gas gives an extract possessing the vinous odour and peculiar bouquet of the wine. (*Dorvault.*)

The average percentages of alcohol in the wines most used in India are:—Marsala, 17·91; Madeira, 20·48; Port, 20·00; Sherry, 17·63; Malaga, 15·00; Sauterne, 15·00; Burgundy, 13·40; Champagne, 11·60 to 12·77; Red Bordeaux, 8—11·00.

According to J. König and C. Kranch, Black raisins contain: Water 23·18, Albuminous matter 2·72, Fat 0·66, Grape sugar 55·62, Other non-nitrogenous matter 14·12, Cellulose 1·94, Ash 1·36. In the dry substance they found Nitrogen 0·56, Sugar 72·43 per cent. Sultana raisins examined by E. Mach and K. Portele yielded—Water 20·4, Dextrose 30·2, Levulose 36·4, Pectin 1·86, Free acids 1·76, Malic acid 0·38, Argol 3·28, Insoluble matter 5·0, Ash 2·03. In the dry substance the total sugar amounted to 83·66 per cent. (*König, Nahrungs-mittel.*)

The leaves of the vine gathered in the early summer contain, according to M. C. Neubaur, tartaric acid, bitartrate of potash, quercetin, quercitrin, tannin, starch, malic acid, gum, inosite, uncrystallizable sugar, oxalates of lime and ammonia, and phosphate and sulphate of lime. In autumn the leaves contain much more quercetin and only a trace of quercitrin. Inosite and malic acid are no longer present.

Commerce.—Grapes are produced in most parts of the table land of India, along the coast the climate is too moist for vine cultivation. A very superior half-dried grape, resembling those sold in Europe, is brought from Cabul packed in chip boxes. The raisins found here are the Sultanas from Cabul and Persia, some of which, very large and of a pale greenish yellow colour, are called *Angul Drákh*; the black bloom raisins (*Kálá Drákh*) from the same countries, which are used for medicinal purposes; and an inferior kind, called *Munakha*, like the pudding raisins sold in England.

Value, Indian grapes, 2 to 4 annas per lb.; Cabul, 4 annas per box, containing about 100 grapes.

Raisins, Cabul and Persian, Rs. 5 to 7 per Surat maund of 37½ lbs.; Bloom, Rs 5; Munakha, Rs 3; Angul Drákh, Rs 6½.

VITIS QUADRANGULARIS, *W al*

Fig.—*Wight Ic.*, *t.* 51; *Rheede, Hort. Mal. vii.*, *t.* 41. Vigne et Raisins de Galam (*Fr.*).

Hab.—India, Arabia. The stalk and leaves.

Vernacular.—Harsankar, Harjora, Nallar (*Hind.*), Pirandai (*Tam.*), Nalleru (*Tel.*), Horjora (*Beng.*), Mangaruli (*Can.*), Chandhári-kandvel (*Mar.*), Chodhári, Harsankar (*Guz.*).

History, Uses, &c.—This is the Ashti-sandhana of Sanskrit writers. The leaves and stalks when young are sometimes used as a vegetable, when older they become acrid and are thought to have medicinal properties. Ainslie says that when dried and powdered they are prescribed by the Tamool practitioners in certain bowel affections connected with indigestion; they are also considered as powerful alteratives; of the powder about two scruples may be given twice daily in a little rice water. Forskahl states that the Arabs when suffering from affections of the spine make beds of the stems.

The juice of the stem is dropped into the ear in otorrhœa, and into the nose in epistaxis; it has also a reputation in scurvy, and in irregular menstruation; in the latter disease, 2 tolás of the juice, extracted by heating the plant, is mixed with 2 tolás of ghi and 1 tolá each of Gopichandan (a white clay) and sugar, and given daily.

Description.—A climbing glabrous plant with fibrous roots; stem 4-angled, winged; stipules lunate entire; leaves very thick and fleshy, alternate, generally 3-lobed, cordate-ovate, serrulated, short petioled; umbels shortly peduncled; stamens 4; petals 4, distinct; fruit globose, size of a large pea, very acrid, one-celled, one-seeded; seed solitary, obovate and covered with a dark brown spongy integument; flowers small, white, appear at the end of the rainy season.

VITIS INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. vii.*, 6. Indian Wild Vine (*Eng.*), Vigne d'Inde (*Fr.*), Uvas dos bugios (*Port.*).

Hab.—Western Peninsula. The tubers.

Vernacular.—Amdhuka (*Hind.*), Amoluka (*Beng.*), Rán-dráksha, Kole-ján (*Mar.*), Sambara-valli (*Tel.*).

History, Uses, &c.—This is a large climbing plant, with perennial tuberous roots; the fruit and leaves as well as the whole appearance of the plant remind one of the Vine. Rheede says that the juice of the root with that of the kernel of the cocoanut is used as a depurative and aperient. The country folk in the Concan also use it as an alterative in the form of a decoction; they consider that it purifies the blood, acts as a diuretic, and renders the secretions healthy. The tubers of **V. latifolia,** Govila (*Beng.*), *Rheede, Hort. Mal. vii.*, 13, *t.* 7, are used for a similar purpose.

Description.—The roots form large bunches of tubers attached to a central root stock; the tubers are from one to two feet long, tapering at both ends, with a maximum diameter, when fresh, of from two to three inches; externally they are covered by a brown epidermis, and marked with small wart-like protuberances arranged in circular rings; internally they are red and juicy. A section shows a thick stringy cortical portion easily separable, and a central fleshy part of the consistence of a parsnip. Under the microscope the root is seen to be made of a thin-walled parenchyma, the cells of which contain large oblong starch granules, and numerous bundles of needle-shaped crystals; the outer portion of the root and root bark is traversed by numerous very large fenestrated vessels. The taste is sweetish, mucilaginous and astringent. The tubers are rich in salts of potash and lime. When fresh they are acrid, owing to the mechanical irritation caused by the needles of oxalate of lime.

LEEA SAMBUCINA, *Willd.*

Fig.—*Rheede, Hort. Mal. ii.*, 26.; *Wight, Ic. t.* 78; *Illus.*, *t.* 58. Syn.—*Leea Staphylea*, Roxb.

Hab.—Hotter parts of India. The roots.

Vernacular.—Kurkur-jihwa (*Beng., Hind.*), Ankados (*Tel.*), Karkani (*Mar.*), Dino (*Goa.*).

History, Uses, &c.—This plant is the Nálugu of Rheede, who gives Dino as the Brahminic name, and says that a decoction of the root is given in colic, and that it is cooling and relieves thirst.

The roasted leaves are applied to the head in vertigo; the juice of the young leaves is digestive. In Goa it is called Dino by the natives and Ratanhia by the Portuguese, and is much used in diarrhœa and chronic dysentery. In Réunion the root is called *Bois de Sureau*, and is said to be used as a sudorific.

Description.—Stems shrubby, with straight branches, leaves pinnate or tripinnate, often 3½ by 4 feet, leaflets stalked, very variable in size and shape, nerves arcuate; flowers greenish-white, anthers connate. Fruit the size of a small cherry, dry. Grows in patches in thick jungle, looking something like Elder. The root is woody, porous and tough, and covered with a striated, dark brown slightly scabrous bark, the internal surface of which is of a deep red colour. The bark has an astringent and rather agreeable flavour; the wood appears to be inert.

Leea macrophylla, *Roxb., Wight Ic., t.* 1154; *Griff., Ic. Pl. As* 645, *f.* 1. Dinda (*Mar.*), Dholsa-mudra (*Beng.*), Dholasa-mudrika (*Sans.*), is a native of the hotter parts of India. The tuberous root is employed in the cure of Guinea-worm, and when pounded is applied to obstinate sores to promote cicatrization; according to Roxburgh the root is astringent and a reputed remedy for ringworm. The young shoots are eaten as a vegetable.

Description.—Stem herbaceous, erect, flexuose jointed; leaves very large, simple, broad cordate, toothed, smooth on both sides; cymes terminal, large; flowers numerous, small, white; berry depressed, size of a small cherry, smooth, black and succulent when ripe; root tuberous. The tubers are of a

deep red colour, 3 to 6 inches long, and 1 to 2 inches in diameter; they are very mucilaginous and astringent. The tubers of *Leea crispa,* Wild., are also used as a remedy for Guinea-worm, and are said to be more efficient than those of *L. macrophylla. Leea hirta,* Roxb. (Kákajangha), is also used medicinally.

The plants of minor importance belonging to the Ampelideæ are:—

Vitis setosa, *Wall., Wight Ic. t.* 170; *Vernacular*—Harmal (*Hind.*), Bara-butsali (*Tel.*), Puli-naravi (*Tam.*), Khájgoli-cha-vel (*Mar.*), an acrid plant sometimes applied as a domestic remedy to promote suppuration and assist in the extraction of Guinea-worms.

Vitis carnosa, *Wall., Wight Ic. t.* 171; *Vernacular*—Amal-bel, Gidar-drak, Kassar (*Hind.*), Kanapa-tige (*Tel.*), Mekamettavi-chettu (*Tam.*), Odi, Ambat-vel (*Mar.*), Khatumbro (*Guz.*), Amal-lata (*Beng.*), Fleshy wild Vine (*Eng.*), used as a domestic application to boils.

Vitis pedata, *Vahl., Rheede Hort. Mal. vii.,* 10, Godhápadi or Iguana's foot in Sanskrit, from a fancied resemblance of the leaves to the foot of that reptile; *Vernacular*—Goali-lata (*Beng.*), Gorpadvel (*Mar.*), used as a domestic remedy on account of its astringency.

Vitis araneosus, *Dalz., Vernacular*—Bendri, Bendervel, Ghorvel (*Mar.*), Kamràj (*Hind.*). The tuberous roots are sold by herbalists as *Chamár-musli,* and used as an astringent medicine. It is called Ghorvel or "Horse vine," from the practice in Western India of giving the young shoots and leaves to horses once a year as a kind of cooling medicine.

Under the names of **Shamraj** and **Bhojraj** short pieces of the stems of two species of Vitis are sold by herbalists in the Central Provinces as a remedy for gonorrhœa. They are both very astringent.

Remarks.—The different species of Vitis and Leea are chiefly remarkable for containing a large amount of tannin, they are therefore useful astringents. Some of them are acrid owing

to the presence in their tissues of needle-shaped crystals of oxalate of lime, which act as a mechanical irritant; as has been shown in the case of the Arums by Pedler and Warden. These acrid plants on being dried lose their acridity from the adhesion together of the bundles of needle-shaped crystals in the plant cells so as to form blunt crystalline masses. The dried tubers and stems can therefore be administered medicinally, and are useful as antacids and diuretics from the large quantity of potash and lime salts which they contain.

SAPINDACEÆ.

CARDIOSPERMUM HALICACABUM,

Linn.

Fig.—*Bot. Mag. t.* 1049; *Griff. Ic. Pl. As. ie., t.* 599, *f.* 3. Heart Pea (*Eng.*), Pois de Marveille, Cœur des Indes (*Fr.*).

Hab.—India. The herb.

Vernacular.—Lataphatkari, Nayáphatkì (*Beng.*), Kána-pháta (*Hind.*), Mooda-cottan (*Tam.*), Bodha, Shib-jal, Kánphuti (*Mar.*), Karodio (*Guz.*), Kánákaia (*Can.*), Vekkudu-tige, Bodha (*Tel.*).

History, Uses, &c.—Sanskrit writers mention this plant under the name of Karna-sphota and Párávata-padi (pigeon's foot); it also bears the synonym of Jyotishmati (see *Celastrus paniculata*); they describe the root as emetic, laxative, stomachic, and rubefacient; and prescribe it in rheumatism, nervous diseases, piles, &c. The leaves are used in amenorrhœa. The following prescription is given in the Bhavaprakasha. Take the leaves of *C. Halicacabum,* impure carbonate of potash (sariká), acorus calamus root, root bark of *Terminalia tomentosa,* of each equal parts, and reduce to a paste with milk. About a drachm of this compound may be taken daily for three days in amenorrhœa. The juice of the plant is dropped into the ears to cure earache and discharge from the meatus,

whence the Sanskrit name Karna-sphota and the Hindi Kána-pháta. It is a favourite vegetable with the Arabs and Egyptians, who call it *Taftaf.* In Tenasserim it is much cultivated for the same purpose. Rheede says that on the Malabar Coast the leaves are administered in pulmonic complaints. According to Ainslie, the root is considered aperient, and is given in decoction to the extent of half a teacupful twice daily. It would appear that in rheumatism the Hindus administer the leaves internally rubbed up with castor-oil, and also apply a paste made with them externally: a similar external application is used to reduce swellings and tumours of various kinds. A medicial plant, called ἁλικάκαβος, and in pure Latin *Vesicaria* (Bladderwort), was known to the Greeks and Romans, and had a reputation for the cure of pains in the bladder. (*Confer. Pliny*, 21, 31.) It is generally considered to have been a species of Physalis. *C. Halicacabum* has been thought by some to be the *Abrong* or *Abrugi* of Serapion, who describes it as a round grain spotted with black and white, which is brought from China, having a bitter taste, hot and dry in the second degree, a laxative and vermifuge. We think that there can be little doubt that the Abrong of Serapion is the fruit of *Embelia Ribes*, the Chitra-tandula or "spotted grain" of the Hindus.

Description.—Annual, climbing; stem, petioles and leaves nearly glabrous; leaves biternate; leaflets stalked, oblong, much acuminated, coarsely cut and serrated; flowers small, white or pink; fruit a membranous bladdery capsule, 3-celled, 3-valved; seeds globose, black, with a two-lobed white aril at the base. Roots white and fibrous, with a rather disagreeable odour, and an acrid nauseous and somewhat bitter taste.

Chemical composition.—The plant owes its medicinal properties to the presence of saponin.

SAPINDUS TRIFOLIATUS, *Linn.*

Fig.—*Wight Ill.*, *t.* 51; *Rheede, Hort. Mal. iv.*, 43, *t.* 19. Soapnut tree (*Eng.*), Savonnier á feuilles de Laurier (*Fr.*).

Vernacular.—Ritha (*Hind.*), Ponnán-kottai (*Tam.*), Ringin, Ritha (*Mar.*), Aritha (*Guz.*), Kunkudu-kayalu (*Tel.*), Antala, Artala (*Can.*).

Hab.—South India, cultivated in Bengal. The fruit.

History, Uses, &c.—The soapnut, in Sanskrit Phenila and Arishta, has probably been in use among the Hindus from the earliest ages as a detergent, and is still used in preference to soap for certain purposes, just as the soapworts were formerly used in the West. Malachias (3) writes: "He is like a refiner's fire and like fuller's *Borith*, &c. In the Septuagint (270 B.C.) Borith is translated 'ποα' and in the Vulgate 'herba'; the old English translation has 'sope.' Malachias' description of the purgation of the sons of Levi is exactly similar to the process to which the Indian goldsmith submits his ornaments. Both Hindus and Mahometans use it medicinally; the latter give it the name of Banduk or Finduk-i-Hindí (Indian Filbert). In the Nighantas it is described as hot, and a preventive of conception. The following account of its properties is extracted from the Makhzan-el-Adwiya:—"The pulp of the fruit is at first sweetish to the taste, afterwards very bitter; it is hot and dry, tonic and alexipharmic; four grains in wine and sherbet cure colic; one miskal rubbed in water until it soaps, and then strained, may be given to people who have been bitten by venomous reptiles, and to those suffering from diarrhœa or cholera. Three or four grains may be given by the nose in all kinds of fits producing insensibility. Fumigations with it are useful in hysteria and melancholy; externally it may be applied made into a plaster with vinegar to the bites of reptiles and to scrofulous swellings. The root is said to be useful as an expectorant. Pessaries made of the kernel of the seed are used to stimulate the uterus in child-birth and amenorrhœa. One miskal of the pulp with one-eighth of a miskal of scammony acts as a good brisk purgative." Rheede describes the tree as anti-arthritic, and says a bath is prepared with the leaves, and the root is administered internally. Ainslie mentions the use of soap-nuts by the Vytians as an expectorant in asthma. In India the

pulp of the fruit is given as an anthelmintic in small doses. The bark is astringent. Soap berries are used in France for washing silk dyed with aniline colours. We have no record of the use of this fruit as a poison for human beings, doses of 70 grains and more appear to have no injurious effect upon the system when taken as a purge.

Description.—Berries three, united, when ripe soft, of a yellowish green colour, singly they are of the size of a cherry, somewhat reniform, with a heart-shaped scar on the attached side. When dry they are of the colour of a raisin, skin shrivelled, pulp translucent, absent on the attached side. The inner shell enclosing the seed is thin, tough and translucent like parchment, except at the scar, where it is woody. Seed the same shape as the fruit, black, smooth, except at the hilum, where it is tomentose, size of a large pea; on the upper part of the dorsum of the seed are two shallow diverging furrows; the testa is double, the outer very thick and hard, the inner membranaceous; kernel yellowish green, oily; cotyledons unequal, thick, firm and fleshy, spirally incurvate. Radicle inferior, linear, lodged at the base of the seed, pointing to the lower and inner angle. The pulp of the fruit has a fruity smell; its taste is sweet at first, afterwards very bitter.

Chemical composition.—The saponin, estimated by weighing the sapogenin formed by boiling with dilute acid, amounts to 11·5 per cent.; this result is confirmed by determining the glucose before and after the treatment and calculating the increase of glucose into the glucoside. The weight of the barium and lead precipitates points to a lower percentage of saponin. The fruits yield to water 40 per cent., and to alcohol 15 per cent. of extract. They contain in a ripe state over 10 per cent. of glucose, and a quantity of pectin, which renders the water solution dfficult of filtration. Submitted to distillation, the drug afforded a small quantity of what appeared to be butyric acid. According to Brannt no saponin is contained in the woody stone, seed or husk. The thick cotyledons contain about 30 per cent. of a white fat, semi-fluid at 20° C.

and melting to a clear oil at 30° C., which possesses a somewhat characteristic odour. The oil saponifies readily, and is employed medicinally and in the manufacture of soap.

S. Mukorassi, *Gärtn. Fruct. I.,* 342, *t.* 70, f. 3, *g, h,* is the soapnut of Northern India, and is called *Dodan* in the Punjab.

Commerce.—Soapnuts are brought to market from many parts of the country. Value, Rs. 2½ to Rs. 3 per pharrah (about 35 lbs.).

SCHLEICHERA TRIJUGA, *Willd.*

Fig.—*Bedd., Fl. Sylv. t.* 119; *Rumph., Herb. Amb. I. t.* 57. Ceylon oak (*Eng.*).

Hab.—N.-W. Himalaya, C. and S. India, Burma, Ceylon. The bark and oil.

Vernacular.—Kosimb (*Hind., Mar.*), Pu-maram (*Tam.*), May, Roatangha (*Tel.*), Puvam (*Mal.*), Sagade, Chakota (*Can.*).

History, Uses, &c.—Rumphius and Roxburgh have both noticed this tree. The pulpy subacid aril of the fruit is edible and palatable. The bark is astringent, rubbed up with oil, the natives use it to cure itch and acne. Lac is produced on the young branches. The wood is very hard, strong and durable; sapwood whitish, heartwood light reddish brown. It is used all over the country for oil, rice and sugar mills, and for agricultural implements and carts. The oil, which is used as a lamp oil in India, is reputed to be the original *Macassar oil;* it has recently reappeared in commerce in Germany as Macassar oil, and has been noticed in Messrs. Gehe and Co.'s trade report as a valuable stimulating and cleansing application to the scalp, which promotes the growth of the hair.

Description.—Drupe the size of a nutmeg, a little pointed, with a grey, fragile husk, covered with soft blunt prickles. Seeds one to three, oblong, smooth, at the base

obliquely truncate, surrounded with a whitish pulpy aril of a pleasant acid taste. Bark with a thick soft suber, the outer layer of which exfoliates in patches; inner bark firm and hard, breaking with a short fracture, of a pale red colour. With ferric salts it turns black. Taste very astringent.

Chemical composition.—The bark contains 9·4 per cent. of tannin in its watery extract, and leaves 10 per cent. of ash.

DODONÆA VISCOSA, *Linn.*

Fig.—*Wight Ill. I., t.* 52. Switch Sorrel (*Eng.*).

Hab.—Throughout India. The leaves.

Vernacular—Sanatta, Ban-mendru (*Hind.*), Jakhmi, Bandári (*Mar.*), Bandrike, Bandri (*Can.*).

History, Uses, &c.—This evergeen shrub or small tree is widely diffused, and in Jamaica is known as "Switch-sorrel." According to Dr Bennett it is called "*Apiri*" in Táhiti, and fillets of it were once used for binding round the heads and waists of victors after a battle. The leaves of *D. Thunbergiana* are said to to be used in South Africa against fevers and as a purgative. In India *D. viscosa* does not appear to have been mentioned by Sanskrit writers, but amongst the people it has a certain amount of reputation as a febrifuge. In Réunion the leaves are esteemed as a sudorific in gout and rheumatism, and in Madras they are said to make a capital poultice; from the gum, resin, and albumen present in them one would suppose that they would retain the heat like a linseed meal poultice. From their astringent properties it is probable that they have some febrifuge virtues, while the resins contained in them appear to keep the bowels open. Buchanan in his "Journey through Mysore" mentions Dodonæa, which he calls "Bandury"; he says it indicates a good soil for the cultivation of horse-gram; and he alludes to its use in germinating rice before it is sown, by covering up the moist rice with the leaves, as if the natives were aware of its resinous or waterproof nature. (*Vol. I., pp.* 255—262.)

Description.—Leaves more or less viscid with a shining yellowish resin, very variable in breadth, 1 to 5 by ½ to 1½ in. They retain their green colour for a considerable time when dried, and when heated in a water-oven fuse together into a mass. Taste sour and astringent.

Chemical composition.—The leaves contain principally two acid resins, one insoluble in ether, and both soluble in alcohol and chloroform. They are dissolved in ammonia and the fixed alkalies with an orange-red colour, and are precipitated on the addition of an acid. The resins amount to 27·3 per cent. of the dried drug. A tannin, giving a greenish colour with ferric salts, forms the bulk of the evaporated spirituous extract soluble in water. The leaves contain 10 per cent. of gum forming a thick ropy liquid in water. No alkaloidal substance was discovered, but a large quantity of albuminous matter was removed by caustic soda. The ash amounted to 5 per cent. of the dried and powdered leaves.

Plants of minor importance belonging to this Order are **Æsculus indica,** the Himalayan Horse Chestnut; the fruit of which is made into a paste and applied externally for rheumatism. The seeds, like those of the European Horse Chestnut, are readily eaten by cattle, and have been made use of as a food by the hill tribes in time of famine. The knots in the stems of **Acer pictum** and **A. cæsium** are made into the curious water-cups supposed by some of the Himalayan hill tribes to have a medicinal influence over the water.

ANACARDIACEÆ.

RHUS CORIARIA, *Linn.*

Fig.—*Dend. Brit.* 136. Elm-leaved Sumach (*Eng.*), Sumac des corroyeurs (*Fr.*).

Hab.—Asia Minor, Persia. The leaves and fruit.

Vernacular.—Sumák or Sumúk (*Arab.*), Tatrak (*Hind.*).

History, Uses, &c.—The leaves have long been well known in Europe and in the East as a tan and dye, and the fruit as a medicine; the latter is described by Theophrastus and Dioscorides under the name of ῥοῦς as the fruit of a plant used for tanning,* Pliny calls them *Rhus*, and Scribonius Largus mentions them as an ingredient in astringent medicines.† Abu Hanifeh in his "Book of Plants" says that Sumák has bunches of small, intensely red berries, and that it does not grow in any part of the land of the Arabs except Syria. Aitchison informs us that it is cultivated in orchards in Khorasan. The author of the Kámus says "the fruit excites the appetite, stops chronic diarrhœa, and an infusion of it is useful in scurvy (سلاق) and for ophthalmia. It does not appear to be used by the Hindus. The tree is well described in the Makhzan-el-Adwiya by Mir Mohammad Husain, who says that the fruit is cold and dry, astringent, and tonic, that it checks bilious vomiting and diarrhœa, hæmoptysis, hæmatemesis, diuresis and leucorrhœa, strengthens the gums, and is useful as an astringent in conjunctivitis. Alone or mixed with charcoal it is applied to sores, suppurating piles, &c. A kind of liquid extract is made by boiling down the leaves and fruit, which is used as an astringent: poultices of the leaves are recommended as an application to the abdomen in the diarrhœa of children. He also mentions the gum and the russet-coloured down of the fruit as having powerfully astringent properties. Ainslie notices the use of the leaf and fruit in India by the Mahometans as a styptic, astringent and tonic; also their former use in France as an astringent in dysentery, in doses of 24 grains.

Description.—The fruit is a small flattened drupe the size of a lentil, of a red colour, containing one lenticular polished brown seed; it is acid and very astringent. The leaves are about a foot long, pinnate, with from 5 to 7 pairs of leaflets and an odd one, like the leaves of the common elm; the

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* Theophr H. P. iii., 18. Diosc. I., 128.
† Plin. 24. 54, Scrib. Comp. 111 and 142.

petioles and midribs of the leaflets are covered with a reddish brown tomentum; the leaflets are hairy and very astringent.

Chemical composition.—The leaves contain colouring matter and 14 to 1[illegible]·5 per cent. of tannin (*Hummel*), and are used in dyeing and calico printing as a substitute for gall nuts, in the production of grey colours, and in Turkey red dyeing; also for tanning the finer kinds of leather. According to Chevreul they contain a yellow colouring matter, which separates from a concentrated decoction on cooling in small crystalline grains. The decoction forms a yellow precipitate with solution of alum, shows a strongly acid reaction with litmus, gives a yellowish white precipitate with stannous chloride, pale yellow with acetate of lead, yellowish brown with cupric acetate, and a blue flocculent precipitate with ferric chloride. Trömsdorf found in the fruit a large quantity of bimalate of lime.

Commerce.—The fruit is imported into Bombay from Persia. Value, 6—8 annas per lb.

The fruit of an Indian Rhus, probably *R. parviflora*, Roxb., or perhaps *R. semi-alata*, Murray, called in Hindi *Tatrak*, is sometimes substituted for it.

PISTACIA INTEGERRIMA, *Stewart.*

Fig.—*Brandis, For. Fl.* 122, *t.* xxii. *Syn.*—Rhus Kákra-singi.

Hab.—Sub-alpine Himalaya. The galls.

Vernacular.—Kákrasingi (*Mar., Guz.*), Kákar-singi (*Hind.*), Kákra-sringi (*Beng.*), Kákkata-shingi (*Tam.*), Kákara-shingi (*Tel.*), Dushtapuchattu (*Can.*).

History, Uses, &c.—These galls, called in Sanskrit Karkata-sringi, have long held a place in the Materia Medica of the Hindus. They are considered tonic, expectorant, and useful in cough, phthisis, asthma, fever, want of appetite, and irritability of stomach. The usual dose is about 20 grains combined with demulcents and aromatics. Mahometan writers describe them as hot and dry, useful in chronic pulmonary

affections, especially those of children, also in dyspeptic vomiting and diarrhœa; they notice their use in fever and want of appetite, and say that they are a good external application in cases of psoriasis. European writers mention the drug, but afford no information as to its properties.

Description and Microscopic structure.—The galls are generally single, but sometimes lobed, of a purse-like form, and vary much in size. The average may be, length 1½ inch, breadth 1 inch, thickness ½ inch. The external surface is of a pale greenish grey, and has a fimbriated appearance. Near the neck or attached end may be seen the midrib of the leaf upon which the gall has been formed; it appears to be split in two; between the halves is a kind of mouth with smooth everted edges (the passage by which the aphides have escaped). On breaking open the gall, which is brittle and about 1-16th of an inch in thickness, the irregular rugose inner surface is seen; it is of a reddish colour, and appears as if covered with particles of dust. This on microscopic examination proves to consist of the *débris* of the former inhabitants of the sac, *viz.*, numerous egg shells beautifully white and transparent, broken portions of the insect, and a quantity of what appears to be excrementitious matter; sometimes the entire aphis may be seen. This insect as obtained from the dry gall is of an oblong form and brown colour, rather more than 1-16th of an inch in length, the whole body is covered with short bristles, four long ones being situated at the end of the abdomen; it has six legs, each armed with two claws; the abdomen is divided into eight segments; the head is armed with a proboscis containing an awl-shaped instrument, and is provided with bristly feelers; the shell of the gall when fractured presents a shining appearance; a thin section shows it to consist of a cellular stroma, the greater number of the cells being entirely filled with a yellowish highly refractive substance. The taste is strongly astringent and slightly bitter.

Chemical composition.—The finely powdered galls of a bright yellow colour were exhausted with boiling water, and the

decoction precipitated with acetate of lead. The precipitate washed and suspended in water was decomposed with sulphuretted hydrogen. The solution filtered from the sulphide of lead was evaporated on a water bath to a small bulk and finally dried over sulphuric acid. The tannin thus obtained was of a yellow colour and amorphous, but on boiling in water and examining under the microscope, the yellow powder which separated on cooling was found to be composed of acicular crystals. The aqueous solution gave a white or yellow precipitate with gelatine, yellow with nitrate of lead, and blue-black with ferric acetate; with ammonia and chloride of barium, a yellow precipitate changing to green and brown, and a similar precipitate with lime water. It yielded a white or yellow precipitate with tartar emetic. With molybdate of ammonium a deep red solution was formed. No precipitate was obtained with bromine water.

The tannin digested in alcohol, and the filtered solution allowed to evaporate by exposure to the air, and finally dried over sulphuric acid, was titrated by Löwenthal's permanganate process, using the solution and observing the details recommended by H. R. Procter.* It was found that 1000 c.c. of a $\frac{1}{20}$ normal solution of permanganate of potash was equivalent to 5·560 grammes of the tannin. Two grams of the finely powdered galls were exhausted by boiling with one litre of water for about half an hour and the solution made up to a litre. Twenty cubic centimetres required, as a mean of three titrations, 22 c.c. of permanganate (1 gram in 1000 c.c.). After precipitation of the tannin by the gelatine solution, 50 c.c. = 20 c.c. of the original solution, required 5 c.c. of permanganate; therefore 17 c.c. are equivalent to the tannin in ·04 grams of the galls. By using the above equivalent, (1000 c.c. $\frac{1}{20}$ normal permanganate = 5·56 grams tannin), the galls would contain 75 per cent. of tannin.

The tannin boiled with dilute sulphuric acid, 1 in 12, for about four hours, deposited an abundant reddish-brown powder, the solution acquiring a claret colour. The powder

* *Pharm. Journ.* [3]. vii. 1020, and [3]. xvi. 843.

filtered out and well washed with cold water, in which it was but slightly soluble, was shaken three or four times with ether. The ether evaporated left a slight amorphous residue. On further shaking up several times with alcohol, and also with dilute sulphuric acid, a cinnamon-brown powder was obtained, which under the microscope was seen to be composed of minute tabular crystals. This powder was very sparingly soluble in alcohol and dilute acids, more readily dissolved by ammonia and potash solutions, forming a deep claret-coloured liquid and turning the undissolved powder a sulphur yellow colour.

Fused with caustic potash the tannin yields proto-catechuic acid. (*J. G. Prebble.*)

Commerce—The drug is imported from Northern India, but not in very large quantities. Value, Rs. 2½ to Rs. 3 per maund of 37½ lbs.

PISTACIA TEREBINTHUS, *Linn.*

Fig.—*Blackw.*, *t.* 478; *Bentl. and Trim. t.* 69. Chian Turpentine tree (*Eng.*), Pistachier Terebinthe (*Fr.*).

Hab.—Europe, Asia, Africa. *Syn.*—P. atlantica, *Desf.* P. palæstina, *Boiss.* P. cabulica, *Stocks.* The oleo-resin.

Vernacular.—Khinjak (*Afgh.*, *Pers.*), Gwan (*Biluch.*), The oleo-resin, Cabuli mastaki.

History, Uses, &c.—Flückiger and Hanbury remark:—"The several forms of this tree are regarded mostly as so many distinct species; but after due consideration and the examination of a large number of specimens both dried and living, we have arrived at the conclusion that they may fairly be united under a single specific name." (*Pharmacographia.*) Aitchison after a careful examination comes to the same conclusion.

The terebinth tree was well known to the ancients; it is the τέρμινθος of Theophrastus, τερέβινθος of other authors, and the

Alah of the old Testament. Among its products, the kernels were regarded by Dioscorides as unwholesome, though agreeable in taste. By pressing them, the original *Oil of Turpentine*, τερεβίνθινον ἔλαιον, a mixture of essential and fat oil was obtained, as it is in the East to the present day. The resinous juice of the stem and branches, the true, primitive turpentine, ῥητίνη τερμινθίνη, was celebrated as the finest of all analagous products, and preferred both to mastich and the pinic resins. (*Pharmacographia.*) The tree was held in veneration by the Jews; Abraham raised an altar to Jehovah near a grove of Pistacia trees in the valley of Hebron; their dead were buried near the tree. Pliny (13, 12,) notices the fruit of the Terebinthus as well as the galls, "from which issue certain insects like gnats," also a kind of resinous liquid which oozes from the bark. Again (24, 18,) he says:—"The leaves and root of the Terebinthus are used as applications for gatherings, and a decoction of them is strengthening to the stomach. The seed is taken in wine for headache and strangury: it is slightly laxative and acts as an aphrodisiac." Aitchison tells us that *P. Terebinthus* occurs in groups on the low hills of Persia and Afghanistan, the kernels are roasted and eaten, and their oil expressed and used with food. The leaves are used in tanning and dyeing, and on their margins are formed small galls quite distinct from those of *P. vera*. These small galls we have observed in the Bombay market for the first time this year offered for sale as Pistachio galls. The turpentine of *P. Terebinthus* is the Butm of the Arabs, and it seems probable that the particular kind produced in Afghanistan, and known in India as *Mastaki*, is the Ilak-el-Ambat or "turpentine of the Nabathæans" of Ishák bin Imrán. It is used as a substitute for true mastich or Ilak-er-Rumi, and sometimes appears in the European markets as East Indian or Bombay mastich. In the East it is considered to be detergent, astringent and restorative. A small quantity of true mastich is imported into India from Turkey.

Description.—The general appearance of Cabul mastich is much the same as that of true mastich, but the colour is

rather deeper, and it wants the fine perfume of the latter article. In the rainy season, unless kept with great care, it runs into a pasty mass. The so-called galls from the margins of the leaves of *P. Terebinthus* are very small sacs, three or four of which communicate together; they are of a pink colour, and have a terebinthinate and astringent taste, and appear to be caused by the presence of an aphis.

Chemical composition.—According to Flückiger and Hanbury, the solution of East Indian mastich in acetone or benzol has the same optical properties as that of true mastich; it deviates the ray of polarised light to the right. (*Pharmacographia.*) East Indian mastich has been examined by Fielding, who found that it differs from the resin of *P. Lentiscus* in being entirely soluble in hot alcohol, becoming only slightly turbid on cooling, whereas 25 per cent. of true mastich remains insoluble in hot alcohol. On the other hand, the latter resin is entirely soluble in turpentine, whereas East Indian Mastich dissolves in hot turpentine but throws down about 25 per cent. on cooling in cauliflower-like crystalline grains. It approaches to the oleo-resin of the European *P. Terebinthus* in these respects, but differs from it in being quite soluble in ether, whereas that oleo-resin gives a cloudy solution with ether, whether hot or cold. True mastich contains a trace of volatile oil and two resins, mastichic acid and masticin. The first is soluble in alcohol without the aid of heat, and has a composition, according to Johnston, of $C^{20} H^{32} O^{2}$. The second resin is insoluble in alcohol but soluble in ether and oil of turpentine; its composition is $C^{20} H^{31} O^{2}$.

Commerce.—The price of Bombay mastich ranges from 8 to 12 annas a pound.

PISTACIA VERA, *Linn.*

Fig.—*Rauw. It.*, 72, *t.* 9; *Guibourt Hist. Nat. iii.*, *p.* 494. The Pistachio nut tree (*Eng.*), Pistachier (*Fr.*).

Hab.—Syria, Persia and Afghanistan. Cultivated in southern Europe. The fruit, galls and husks.

Vernacular.—Darakht-i-pisteh (*Pers.*) The fruit, Pisteh (*Pers., Ind.*). The galls, Buzghanj (*Pers.*), Gul-i-pisteh (*Pers., Ind*), Getela (*Beng.*).

History, Uses, &c.—The tree forms forests at an altitude of 3,000 feet in the Badghis and Khorasan; it is also cultivated in Persia. The forests are known as Pistalik, and are a source of considerable profit to their owners. (*Aitchison.*) The wild fruit is smaller and more terebinthinate in flavour than the cultivated. Many people prefer it. Pistachio nuts were known to the ancients, who introduced the tree into Europe According to Pliny, they were first brought to Rome by Lucius Vitellius, Governor of Syria, about the end of the reign of Tiberius. From Rome they were carried into Spain, and are now cultivated throughout Southern Europe. The Arabs call Pistachio nuts Fustuk, and consider them to be digestive, tonic and aphrodisiac; they prepare a loch (لوخ) with them, which is known in French Pharmacy as *Looch vert ou des pistaches.* The outer husk of the fruit is used in dyeing and tanning, and is imported into Bombay from Persia under the name of *Post-i-písteh.* The galls which are produced on the leaves of the tree are terebinthinate and astringent, and are used in dyeing and tanning, and also as an astringent medicine; they are called Buzghanj in Persia, but are best known as Gul-i-pisteh in India. The word Buzghanj appears to be derived from *Biz,* an old Persian name for a bee or fly or other buzzing insect, and *Ghanj,* a bag or sack. The Mahometans use Pistachio nuts in cookery and medicine.

In India they are roasted in their shells in hot sand, and thrown into a hot paste of salt and water, and stirred so as to cause the salt to adhere to the shell, much as sugar does to a burnt almond. They are hawked about the streets in large towns under the name of *Khára Pistch* (salted Pistachio nuts). The almonds are much used by sweetmeat makers.

Description.—The galls when fresh are bright pink on one side and yellowish white on the other; they vary much in shape and size, some being perfectly fig-shaped and others almost spherical, the majority are ovoid; at one end a portion of leaf

often remains attached; here may be seen an open stoma which communicates with the interior of the sac; the apices are pointed, often mucronate. The largest galls are an inch in length; some are no larger than a pea. The walls are thin, brittle, and translucent; the taste acidulous, very astringent and slightly terebinthinous; the odour terebinthinous. Most of the sacs contain only a little fecal *debris*, but in some an aphis may be found. According to Lichtenstein this aphis (*Anopleura Lentisci*) runs through the following stages:—The fecundated female deposits in May or June its eggs on the pistachio tree; these hatch into a wingless form, to which the pistachio gall owes its origin; the wingless form produces, withont being fecundated, another brood, which acquire wings and quit the gall and pass to the roots of certain grasses (*Bromus sterilis* and *Horduem vulgare*), and then produce wingless young, and these, after a longer or shorter series of wingless generations, until the period of swarming and of the appearance of the nymphs, furnish a winged sexual generation, which return to the pistachio tree and again commence the cycle.

The fruit of the Pistachio is about the size of an olive, and consists of a moist reddish husk having an astringent taste and terebinthinate odour, which encloses a white woody shell separating into two valves and containing an angular almond having a thin purplish red skin, within which are two green oily cotyledons having an agreeable somewhat terebinthinate flavour. Rubbed with water the seed forms an emulsion.

Chemical composition.—65 per cent. of the galls is soluble in water, 75 per cent. in spirit and 31 per cent. in ether. They contain 45 per cent. of tannin allied to gallo-tannic acid, besides gallic acid, and 7 per cent. of a resin or oleo-resin to which the odour is due.

MANGIFERA INDICA, *Linn.*

Fig.—*Beddome Fl. Sylv.*, *t.* 162; *Gart. Fruct.*, *t.* 100. Mango tree (*Eng.*), Manguier (*Fr.*).

Hab.—East Indies. Cultivated elsewhere. The fruit, kernel, leaves, flowers, bark and gum.

Vernacular.—Amb, Am (*Hind.*), Amba (*Mar.*), Manga-maram (*Tam.*), Ambaj (*Arab.*), Naghzak (*Pers.*), Ambo (*Guz.*), Ma (*Mal.*).

History, Uses, &c.—The Mango, in Sanskrit Ámra, Chúta and Sahakara, is said to be a transformation of Prajápati (lord of creatures), an epithet in the Veda originally applied to Savitri, Soma, Tvashtri, Hiranga-garbha, Indra, and Agni, but afterwards the name of a separate god presiding over procreation. (*Manu* xii., 121.) In more recent hymns and Bráhmanas Prajápati is identified with the universe.

The tree provides one of the *pancha-pallava* or aggregate of five sprigs used in Hindu ceremonial, and its flowers are used in Shiva worship on the Shivarâtri. It is also a favourite of the Indian poets. The flower is invoked in the sixth act of Sakuntala as one of the five arrows of Kámadeva. In the travels of the Buddhist pilgrims, Fah-hian and Sung-yun (translated by Beal) a Mango grove (Ámravana) is mentioned which was presented by Ámradárika to Buddha in order that he might use it as a place of repose. This Ámradárika, a kind of Buddhic Magdalen, was the daughter of the mango tree. In the Indian story of Súrya Bai (*see Cox, Myth. of the Arian Nations*) the daughter of the sun is represented as persecuted by a sorceress, to escape from whom, she became a golden Lotus. The king fell in love with the flower, which was then burnt by the sorceress. From its ashes grew a mango tree, and the king fell in love first with its flower, and then with its fruit; when ripe the fruit fell to the ground, and from it emerged the daughter of the sun (Súrya Bai), and was recognized by the prince as his lost wife. Long articles upon the virtues of the mango in its ripe and unripe state (kéri) may be found in Hindu and Mahometan works on Materia Medica.

The Turkoman poet, Amír Khusru, who lived in Delhi in the time of Muhammad Tughlak Shah, says of it:—

نغزک خوش نغزکن بوستان   نغزترین میوۀ هندوستان
میوه بباغ ار نر یکی ده بود   پخته شود خوردنش انکه شود
میوۀ نغزک هم از آغاز بر   تا حد انجام سزاوار خور

"The mango is the pride of the garden, the choicest fruit of Hindustan; other fruits we are content to eat when ripe, but the mango is good in all stages of its growth."

Shortly, we may say that they consider the ripe fruit to be invigorating and refreshing, fattening, and slightly laxative and diuretic; but the rind and fibre, as well as the unripe fruit, to be astringent and acid. The latter when pickled is much used on account of its stomachic and appetising qualities. Unripe mangos peeled and cut from the stone and dried in the sun form the well-known Ámchúr or Ambosí (Ámrapesi, *Sans.*,) so largely used in India as an article of diet; as its acidity is chiefly due to the presence of citric acid, it is a valuable antiscorbutic; it is also called Ám-ki-chhiṭṭa and Ám-khushk. The blossom, kernel and bark are considered to be cold, dry and astringent, and are used in diarrhœa, &c., &c. The smoke of the burning leaves is supposed to have a curative effect in some affections of the throat. According to the author of the Makhzan, the Hindus make a confection of the baked pulp of the unripe fruit mixed with sugar, which in time of plague or cholera they take internally and rub all over the body; it is also stated in the same work that the midribs of the leaves calcined are used to remove warts on the eyelids. Mangos appear to have been known to the Arabs from an early date as a pickle; they were doubtless carried to Arabian ports by Indian mariners. Ibn Batuta, who visited India A.D. 1332, notices their use for this purpose. The powdered seed has been recommended by Dr Kirkpatrick as an anthelmintic (for lumbrici) in doses of 20 to 30 grains, and also as an astringent in bleeding piles and menorrhagia. (*Phar. of India, p.* 59.) From the fruit just before ripening, a gummy and resinous substance exudes, which has the odour and consistence of turpentine, and from the bark a gum is obtained which is partly soluble in cold water. Ainslie says that the gum-resin mixed with lime-juice or oil is used in scabies and cutaneous affections. The juice of the ripe fruit dried in the sun so as to form thin cakes (Amras, or Amaut, *Hind.*, Ambapoli, *Mar.*, Amravarta, *Sans.*,) is used as a relish and antiscorbutic. Mango bark and fruit have been lately introduced by

Dr. Linguist to the notice of European physicians (*Practitioner*, 1882, 220); he recommends it for its extraordinary action in cases of hæmorrhage from the uterus, lungs, or intestines. The fluid extract of the bark or rind may be given in the following manner:—Ext. Fl. Mangif. Ind., 10 grams; water, 120 grams. Dose—One teaspoonful every hour or two, or the juice of the fresh bark may be administered with white of egg or mucilage and a little opium.

The wood is used largely for packing cases and tea chests, but it should be previously seasoned, otherwise the acid juice it naturally contains corrodes the lead.

Description—The Mango is a large fleshy drupe, ovoid or kidney-shaped; it varies much in size, ordinarily it is about as large as a goose's egg, but in the Southern Concan and Goa there is a variety called Bispo or the Bishop, which attains the size of a child's head. The pulp has a terebinthinate sweet and acidulous taste. The nut varies in size, is somewhat reniform and laterally compressed; it consists of a woody endocarp covered with woody fibres. The seed has two distinct membranous envelopes, the outer one is of the nature of an aril and white, the inner or proper integument consists of two coats closely united, the outer white, the inner of a dark red colour. The two cotyledons are spirally twisted, and lobed, their taste bitter and astringent. The gum occurs in irregular-shaped pieces, some of them stalactiform and shining; it is variable in colour and solubility, brittle, the fractured surface dull, the odour faint and gummy. At the time of flowering a gum-resinous exudation occurs upon the tender portions of the plant.

Chemical composition.—Professor Lyon (1882) examined the dried unripe peeled fruit, and found it to contain water 20·98, watery extract 61·40, cellulose 4·77, insoluble ash 1·43, soluble ash 1·91., alkalinity of soluble ash as potash ·41, tartaric acid, with a trace of citric acid 7·04, remaining free acid as malic acid 12·66, total free acid per 100 parts air dry substance 24·93.

The orange colouring matter of the ripe mango is a chlorophyll product, readily soluble in ether, bisulphide of carbon

and benzol, but less readily soluble in alcohol. It yields with these solvents deep orange-coloured solutions which are bleached by solution of chlorinated soda, and turned green by hydrochloric or sulphuric acids, the orange colour being again restored by an alkali.

The bark and seeds contain a tannin. Fifty grams of the powdered seed exhausted with alcohol, 90 per cent., filtered, the alcohol evaporated off on the water bath, and the residue dried over sulphuric acid, left an extract weighing 3·16 grams. Of this extract ·3 gram was of a resinous nature, and insoluble in water. The portion soluble in water, equivalent to 5·72 per cent. of the seed, gave the usual reactions of a tannin. The aqueous solution of the tannin was precipitated with gelatine, filtered, and the filtrate shaken two or three times with ether. No appreciable residue was obtained by the evaporation of this ethereal extract showing the absence of gallic acid. (*J. G. Prebble.*)

ANACARDIUM OCCIDENTALE, *Linn.*

Fig.—*Beddome Fl. Syl.*, *t.* 163; *Rheede, Hort. Mal. iii.*, *t.* 54. Cashew-nut tree (*Eng.*), Anacardier (*Fr.*).

Hab.—America. Cultivated in India. The tar, spirit and almonds.

Vernacular.—Kájú (*Hind.*, *Guz.*, *Mar.*), Kottai-mundiri (*Tam.*), Hijli-bádám (*Beng.*), Jidi-mámidi-vittu (*Tel.*), Gera-poppu (*Can.*).

History, Uses, &c.—A native of Brazil, which has been introduced into India by the Portuguese. Rumphius tells us that the fruit is called in Amboyna *Boa Frangi*, or Portuguese fruit; it was not known in Goa A.D. 1550; but Christopher a Costa saw it in Cochin shortly after this. The later Mahometan writers notice it as a variety of Biládur (*Semecarpus Anacardium*), and call it Bádám-i-Farangi. In 1653 only a few trees existed on the Malabar Coast; since then it has become completely naturalized on the Western Coast,

but is nowhere so abundant as in the Goa territory, where it yields a very considerable revenue. It is planted upon the low hilly ridges which intersect the country in every direction, and which are too dry and stony for other crops. The cultivation gives no trouble, the jungle being simply cut down to make room for the plants. When three years old the trees begin to bear. The principal products are, a spirit distilled from the fermented juice of the torus, the kernels of the nuts, and a tar obtained by roasting the pericarp of the fruit. The apparatus used for extracting the juice from the torus consists of a large circular stone basin with a spout, into which a heavy circular stone is fitted. The torus having been sliced and well trodden by the feet, is placed in the basin and the stone weight placed upon it; after all the juice has been expressed, it is allowed to ferment in earthen jars, and then distilled. The product is a weak spirit, which is sold for about 4 annas a gallon, and is also re-distilled to about the strength of proof-spirit, when it is worth about Re. 1¼ per gallon. The fruit is roasted in an earthen perforated vessel until the whole of the tar (Deek) has been extracted from the pericarp. The kernel which has become roasted slightly during this process is then removed and preserved for sale. The tar is largely used for tarring boats and wood-work, which it preserves from the attacks of insects. The nuts are exported, and are used in making native sweetmeats, and as a table fruit by Europeans. From the juice of the torus a kind of wine is made by the Portuguese: both it and the spirit are considered to have diuretic and sudorific properties, and are valued as external applications in rheumatism. The leaves and flowers of the cashewnut are aromatic; from the stem exudes a large quantity of gum in stalactitic masses sometimes as thick as a man's wrist; it is made no use of in Goa, but is said to be used in America by book-binders to keep their books from the attacks of insects. The bark though not used in India is said to have alterative properties; it is rich in tannic acid, and a decoction makes a good astringent wash. The tar already mentioned, which contains about 90 per cent. of anacardic acid and 10 per cent. of cardol, has recently been recom-

mended as an external application in leprosy, ringworm, corn and obstinate ulcers; it is powerfully rubefacient and vesicant, and requires to be used with caution. In native practice it is sometimes used as a counter-irritant. MM. Corre and Lejanne (*Résumé de la Mat. Med. et. Tox. Coloniale*) state that a good epispastic ointment may be made by incorporating one part of it with eight parts of lard or vaseline, and a blistering paste by mixing it with wax in equal proportions. Dr. Brassac considers it to be a good, rapid, and safe vesicant, producing a copious flow of serum and notable reduction of hypertrophy in tuberculous leprosy; he advocates its general use as a vesicant. (*Rapport sur la méthode Beauperthuy, Basse Terre*, 1872.) In Europe a tincture of the pericarp (1 to 10 of rectified spirit) has been used in doses of 2 to 10 minims as a vermifuge. It is stated (Buchheim) that the oil has a very faint and hardly acrid taste, and that 3 or 4 drops of it may be swallowed without marked effects. This contrast with its action on the skin is attributed to its total insolubility in the watery fluids of the digestive canal. According to Basiner, the sub-cutaneous injection of small doses of cardol produces on cold-blooded animals paresis, increasing to paralysis of the extremities, stupor, paralysis of respiration and tetanic spasms. In warm-blooded animals large doses are not lethal, but stupor, paralysis of the extremities and diarrhœa occur, and after death congestion of the intestinal lining is found. Cardol seems to be excreted chiefly with the urine, but partially also with the fæces. Applied on a small piece of lint to the skin of the breast it raised a watery blister in 14 hours. (*Am. Journ. Pharm., Mar.* 1882, p. 131.) The kernel contains a bland fixed oil; it may be eaten raw or roasted.

Description.—The fruit, which is about an inch in length and kidney-shaped, is seated upon a large pyriform fleshy body 2 to 3 inches long, and coloured like an apple red and yellow, formed of the enlarged disk and top of the peduncle. The pericarp is cellular and full of oil; seed kidney-shaped; testa membranaceous, adherent; cotyledons semilunar; radicle short, hooked. The spirit has a peculiar

and rather disagreeable flavour, which appears to be derived from a volatile aromatic principle present in the rind of the torus and similar to the ferment oil of apples; this can be removed by proper rectification. The gum occurs in stalactiform masses, and varies in colour from reddish to pale yellow; when placed in water it swells and forms a jelly-like mass and a portion of it dissolves; this solution is rendered turbid by oxalate of ammonium, and gives a copious white precipitate with alcohol; it is not precipitated by borax or sulphate of iron.

Chemical composition.—Anacardic acid together with cardol is contained in the pericarps of the cashew nut. To obtain it they are extracted with ether, which dissolves out both the anacardic acid and the cardol; the ether is distilled off, and the residue after washing with water to free it from tannin, is dissolved in 15 to 20 times its weight of alcohol. This alcoholic solution is digested with recently precipitated oxide of lead, which removes the anacardic acid in the form of an insoluble lead salt. After repeated purification the acid is obtained as a white crystalline mass which melts at 26° C. It has no smell, but its flavour is aromatic and burning. When heated to 200° C. it is decomposed, producing a colourless very fluid oil. It burns with a smoky flame, emitting an odour like that of rancid fat. Alcohol and ether dissolve it readily, and these solutions redden litmus. Some of its salts are crystalline. Formula $C^{44} H^{64}.O^{7}$, or $C^{44} H^{32} O^{7}$. MM. Ruhemann and Steinner, who have recently (1887) exmined anacardic acid, give it the formula $C^{44} H^{56} O^{6}$, and consider it to be hydroxy-carboxylic acid. By acting upon iodide of methyl with its silver salt, they obtained a methyl compound which was decomposed by distillation with a disengagement of carbonic acid. (*Jour. of the Chem. Soc.*, 1887, p. 663.) After the removal of the anacardic acid, the alcoholic solution which contains the cardol is distilled to recover the spirit, and water added to the remaining liquid till it becomes turbid, and afterwards acetate and subacetate of lead till it is decolorised; lastly, the lead is precipitated by sulphuric acid. Cardol is a yellow oily liquid, insoluble in water, very

soluble in alcohol and ether; the solutions are neutral to litmus. This substance is not volatile, but decomposes when heated. It blisters the skin strongly. According to Stadeler, it contains 60 per cent. of carbon and 8·8 or 8·9 of hydrogen, whence he deduces the formula $C^{12} H^{31} O^{4}$; it should perhaps be $C^{21} H^{30} O^{2}$. (*Cf. Stadeler, Ann., Ch. Pharm.*, lxiii., 137.)

The oil of the almonds is sweet, pale-yellow, sp. gr. 0·916; that of the mesocarp is thick, brown and viscid, sp. gr. 1·014; it reddens litmus, and turns darker when exposed to the air; it is soluble in alcohol and ether, and dyes linen of a permanent yellow-red. (*Lepine*)

This oil was found by A. Basiner (1881) to be soluble in potassa, with a red colour, darkening on exposure, and its alcoholic solution to yield a red precipitate with basic lead acetate. Cazeneuve and Latour have found catechin in the wood of the Cashew tree. The fruit yields 1·64 per cent. of ash. (*Wernecke.*)

Commerce.—Cashew nuts (Fèves de Malac, *Fr.*) are imported into Bombay from Goa in very considerable quantities. Value—The Kernels, Rs. 18 per cwt.; the Tar, Re. ¼ per gallon in Goa.

SEMECARPUS ANACARDIUM, *Linn.*

Fig.—*Roxb. Cor. Pl. I., t.* 12; *Wight Ic., t.* 558; *Beddome Fl. Sylv., t.* 166. Marking-nut tree (*Eng.*), Sémécarpe á larges feuilles (*Fr.*).

Hab.—Hotter parts of India. The fruit.

Vernacular.—Bhéla, Bhilawa (*Hind.*), Bibba (*Mar.*), Shénkottai, Sheran-kottai (*Tam.*), Bhilamo (*Guz.*), Geru (*Can.*), Sambiri, Thembari (*Mal.*).

History, Uses, &c.—The marking-nut, in Sanskrit Bhallataka and Arushkara (causing sores), is regarded by the Hindus as acrid, heating, stimulant, digestive, nervine and escharotic, and is used in dyspepsia, piles, skin diseases, and nervous debility. It is prepared for internal use by being boiled with cowdung and afterwards washed with cold water.

The nut is also used to produce the appearance of a bruise in support of criminal charges preferred through enmity,* and the juice is sometimes applied to the body out of revenge, the victim having first been made insensible by the administration of narcotics. In Sanskrit medicinal works a section is often devoted to the treatment of ulcerations thus produced. When given internally the juice of the pericarp is always mixed with oil or melted butter. It is the Anacardia of Serapion. The Arabic name for the nut is Baládar, or Hab-el-ḱalb, in allusion to its heart-shaped form.

Ibn Baitar says—

البلادر بالهندیہ ہو القرديا بالروميہ و معناه الشبيہ بالقلب

(Baládar in the Indian language is Ancardia in Greek, which means "heart-shaped.") Mahometan writers order the juice to be always mixed with oil, butter, or some oily seed when used for internal adminstration. They consider it to be hot and dry, useful in all kinds of skin diseases, palsy, epilepsy, and other affections of the nervous system, the dose being from ¼ to ½ a dirhem. Externally they apply it to cold swellings, such as piles; the Tuhfat notices the use of the vapour of the burning pericarp for this purpose, a practice known in Bombay; it causes sloughing of the tumours. When too large a quantity has been taken, oily and mucilaginous remedies should be prescribed. Two dirhems is considered a poisonous dose. Some persons are much more readily affected by the drug than others. Garcia d'Orta remarks that the poisonous properties of the marking-nut have been much exaggerated by Serapion, and goes on to say that in Goa it is administered internally in asthma after having been steeped in buttermilk, and is also given as a vermifuge: and moreover says he, we (the Portuguese) salt the young green fruit and use them like olives. Ainslie gives the following account of its use in Southern India: "The Hindus give the juice in scrofulous, venereal and leprous affections in very small doses; an oil is also prepared with the nut by boiling, which is used externally

* Its application in a diluted form produces great œdematous swelling and redness of the skin.

in rheumatism and sprains, it is of a very stimulating nature; undiluted it acts as a blister. The Telingoos have the following prescription:—Juice of marking-nut and garlic of each 1 ounce, juice of fresh tamarind leaves, cocoanut oil and sugar of each 2 ounces; mix, and boil for a few minutes. Dose—One table spoonful twice daily in syphilis, aches, sprains," &c. Mixed with a little quicklime and water the juice is used all over India for marking linen, and the stain is far more durable than that of the marking inks of Europe.

In the Concan a single fruit is heated in the flame of a lamp and the oil allowed to drop into a quarter ser of milk; this draught is given daily in cough caused by relaxation of the uvula and palate. As an application to scrofulous glands of the neck equal parts of the juice of the marking nut, *Plumbago zeylanica, Baliospermum montanum, Euphorbia neriifolia, Asclepias gigantea*, sulphate of iron, and molasses are used. The juice of the root-bark is also used medicinally on account of its acrid properties.

The brown oil of the marking-nut appears to resemble very closely in its medicinal action that of the cashew-nut (see above). Basiner found that within 12 hours it raised a black blister; this should be carefully protected from touch, as the fluid causes eczematous vesicles on any part of the body it may come in contact with. Basiner has also noticed painful micturition, the urine being reddish brown and bloody, and painful stools as a sequel to the external application of the oil. (*Am. Journ. Pharm. Mar.* 1882, p. 131.) In a case of accidental blistering by the juice, recently under clinical observation in Calcutta, and reported by Dr. C. L. Bose, the most marked feature was its prolonged irritant action on the skin, although washed off with cold water within a quarter of an hour of the accident. Blisters began to appear about two hours after the application of the juice, and continued to form for three days, apparently caused by the fluid from the broken vesicles. No irritation of the bladder or intestines was observed, but there was intolerable itching and burning of the skin attended by a febrile condition. Most relief was obtained by the

application of hot oil. Like the oil of the cashew-nut, this oil appears to have a much less injurious effect than would be expected, when administered internally.

Toxicology.—The marking-nut is seldom if ever given as a poison internally, but is used as a local irritant to procure abortion, often causing much injury to the uterus and vagina; a case of this kind is recorded by Chevers and another by Burton Brown. In Bombay a case has been reported in which the juice was used to cause hurt to a wife by disfiguring her face, and Dr. Gray has observed a case in which the nut was introduced into the vagina as a punishment. Marking-nuts have also been used by malingerers to produce ophthalmia and skin eruptions.

Description.—The marking-nut is well described by the Arabs as resembling the heart of an animal, the torus representing the auricles, and the fruit the ventricles; in the dry commercial article the torus is seldom present, and the fruit is of the size and shape of a broad bean, of a black colour, and quite hard and dry externally, but upon breaking the outer skin with a knife, the central cellular portion of the pericarp will be found full of a brown oily acrid juice; inside the pericarp is a thin shell conforming to it, and containing a large flat kernel, which has no acrid properties. The root-bark is very thick, and contains a large quantity of acrid juice similar to that found in the pericarp; it dries into a black varnish.

Chemical composition.—The almonds contain a small quantity of sweet oil; the pericarp contains 32 per cent. of a vesicating oil of specific gravity ·991, easily soluble in ether, and blackening on exposure to the air. It is similar to that of *Anacardium occidentale,* but Basiner (1881) found that it dissolves in potassa with a green colour, and its alcoholic solution turns black with basic lead acetate. The fruit yields 2·14 per cent. of ash. (*Warnecke.*)

Commerce.—Marking-nuts come from various parts of the country. Value, ¾ to 1 Rupee per Surat maund of 37½ lbs.

ODINA WODIER, *Roxb.*

Fig.—*Wight Ic., t.* 60; *Beddome Fl. Sylv., t.* 123; *Royle Ill., t.* 31.

Hab.—Hotter parts of India. The bark and gum.

Vernacular.—Jingan Mohin, Kimul (*Hind.*), Shimti (*Can.*), Odiya-maram (*Tam.*), Jival (*Beng.*), Uthi (*Mal.*), Oddi-mánu (*Tel.*), Moye (*Mar.*), Shembat (*Guz.*).

History, Uses, &c.—This tree is called in Sanskrit Jingini, Ajashringi (goat's horn), and Netraushadhi (collyrium). The juice is considered by the Hindus to be a valuable application to sore eyes. Ainslie mentions that the bark powdered and mixed with Margosa oil is considered by the Vytians as a valuable application to old and obstinate ulcers; according to Wight, the gum beaten up with cocoanut milk is applied to sprains and bruises, and the leaves boiled in oil are used for a similar purpose. In the Pharmacopœia of India the astringent properties of the bark are noticed, and its use as a lotion in impetiginous eruptions and obstinate ulcerations. A decoction of the bark is recommended by Dr. B. Bose as an astringent gargle. At Pondicherry the bark is administered in gout and dysentery; it has a stimulant action. (*Corre et Lejanne.*)

Description.—The gum is partly in tears of a yellowish tinge, and partly in colourless angular fragments, which are full of fissures like gum Arabic. It has a disagreeable taste and is not astringent, about one-half of it is completely soluble in water, the remaining portion forms a slimy mucilage, but is not gelatinous; the soluble portion, which is feebly acid, is precipitated by alcohol, and in a less degree by oxalate of ammonium, not at all by perchloride of iron or borax. The bark is very astringent, thick and soft, of a light brown colour externally, marked with numerous whitish scars, where portions of the dry suber have fallen off, also with many small scabrous rusty spots; internally it is white when fresh, but dries of a reddish brown, a gummy juice exudes from it when cut; there are large laticiferous vessels which contain the gummy juice.

Chemical composition.—The powdered bark exhausted with hot water affords 15 per cent. of extract containing 9·1 per cent. of tannin. The ash (9·3 per cent.) is very deliquescent on account of the presence of a considerable quantity of potassium carbonate.

BUCHANANIA LATIFOLIA, *Roxb.*

Fig.—*Bedd. Fl. Sylv.* t. 165.

Hab—Hot, drier parts of India, ascending to 3,000 feet. The seeds.

Vernacular.—Chironji, Piyár, Piyál (*Hind.*), Chirongi, Piyál (*Beng.*), Chároli (*Guz.*), Chára, Chároli (*Mar.*), Moreda, Mouda (*Tam.*), Chára-pappo, Morala (*Tel.*), Nuskul, Murkalu (*Can.*), Chirauli (*Punj.*), Mura, Munga Peru (*Mal.*).

History, Uses, &c.—This tree is called in Sanskrit Piyála, Chára and Tápasa-priya, or "dear to hermits." The seeds are an article of commerce, and appear to have been in use from a remote period in the preparation of sweetmeats, and as an ingredient in demulcent cough mixtures, generally in combination with dates, almonds, sesamum and cucumber seeds. Similar mixtures are also prescribed as a nourishment in debility. Charred slightly over the fire they form an excellent after-dinner dish. The oil has been recommended for baldness. The bark is used in Tranvancore for tanning.

Description—The fruit is a sub-globose, slightly compressed drupe, half inch in diameter, of a deep purple colour. Stone hard, 2-valved. Kernels laterally compressed like a vetch seed, brown, mottled with darker brown, rather more than ½ inch in length, and rather less than ¼ inch in breadth. Slight pressure separates the oily cotyledons, which have a very agreeable nutty flavour.

Chemical composition.—The seeds have been examined by Church, who found in 100 parts—Water 5 7, albuminoids 27·9, mucilage, &c., 2·7, oil 58·6, fibre 1·8, ash 3·3. The expressed oil of the seeds commences to congeal into a white semi-solid

mass at 18·5° C., at which temperature it has a specific gravity of 0·9134. It affords 95·7 per cent. of insoluble fatty acids melting at 36°. The lead soap of the fatty acids was soluble to the extent of 38 per cent. in ether, as lead oleate; the fatty acids from the insoluble portion melted at 57°, and possessed the characters of a mixture of palmitic and stearic acids.

Commerce.—Chirongi seeds are obtainable at about 4 annas per pound.

SPONDIAS MANGIFERA, *Willd.*

Fig.—*Wight Ill. I.* 186, *t.* 76; *Bedd. Fl. Sylv.*, *t.* 169. Hog plum tree, Wild mango (*Eng.*), Mombin de Malabar (*Fr.*).

Hab.—Throughout India. The fruit and gum.

Vernacular.—Ambra, Amra (*Hind.*, *Beng.*), Ambáda (*Mar.*), Mari-manchedi (*Tam.*), Toura-mamidi (*Tel.*), Pundi (*Can.*)

History, Uses, &c.—This tree is the Amrátaka, Amrát, and Adhvaga-bhogya (traveller's delight) of Sanskrit writers, who describe the pulp of the fruit as acid and astringent and useful in bilious dyspepsia, on which account the name of Pittavriksha, or "bile tree," is applied to it. It is the Condondum Malaccense of Rumphius (I., 51). The fruit is much used by the Hindus as an acid vegetable, and they make a preparation of it resembling gooseberry fool, which is called Ráyetó.* The leaves and bark are astringent and aromatic, and are administered in dysentery, and the gum is used as a demulcent.

Description.—The drupe is oval, fleshy, smooth, the size of a pullet's egg, and yellow when ripe; nut oblong, woody, very hard, outwardly fibrous, 5-celled, from 1 to 3 cells only are fertile; seed lanceolate; embryo inverse, without perisperm. The gum is yellowish or light brown, principally in

* रायतें (*Mar.*), रायता (*Hind.*) is a semi-fluid dish prepared with a little mustard, milk, and the pulp of some acid fruit.

stalactiform pieces. It resembles tragacanth in its behaviour with water, 40 grains form with 2 ounces of water a transparent jelly of a light brown colour, in a dilute solution the insoluble portion deposits, and the small portion which is soluble gives with neutral acetate of lead a white precipitate, with basic acetate an opaque white precipitate, with ferric chloride a reddish gelatinous precipitate, with Fehling's solution there is a slight reduction on boiling, with ammonium oxalate a copious precipitate, it is precipitated by alcohol, but is unaffected by iodine, nitrate of silver and borax.

A remarkable gum-like secretion is yielded by a species of Spondias introduced in Bangalore. It dissolves without swelling in water, and forms a milky and soapy solution. One-sixth of this substance is soluble in rectified spirit, and although insoluble in water is unctious and soapy to the touch.

MORINGEÆ.

MORINGA PTERYGOSPERMA, *Gärtn.*

Fig.—*Wight Ill. I.* 186, *t.* 77; *Bedd. Fl. Syl., t.* 80. The Horse-radish tree (*Eng.*), Moringa à graines triptères (*Fr.*),

Hab.—India. The fruit, bark, gum, seeds and root.

Vernacular.—Sahjna (*Hind.*), Shegva, Shegat (*Mar.*), Murungai (*Tam.*), Saragavo (*Guz.*), Nugge (*Can.*), Munaga (*Tel.*).

History, Uses, &c.—The root of this very common tree, the Sobhanjana, Murungi and Danshamula (pungent root) of Sanskrit writers, is described by the Hindus as acrid, pungent, stimulant and diuretic, and is applied externally as a rubefacient. The seeds are said to be stimulant and are called Sveta maricha (white pepper). The Bhavaprakása mentions two varieties of the tree, *viz.*, white and red.* The white is said to be the stronger rubefacient, but the red is preferred for internal use; it is given in ascites arising from enlargement of the liver and

* Probably *M. concanensis*, Nimmo, which has red flowers.

spleen. In internal and deep-seated inflammation and abscess (vidradhi), a decoction of the root bark is recommended to be given with the addition of asafœtida and rock salt. The root bark is besides used externally as a plaster, and the inflamed part fomented with its decoction. A decoction of the root bark is considered useful in calculous affections. The seeds are an ingredient in some stimulant applications. The gum of the tree, mixed with sesamum oil, is recommended to be poured into the ears for the relief of otalgia; it is also rubbed with milk and applied in headache to the temples. Mahometan writers describe Sahjna flowers as hot and dry, and consider that they expel cold humours, disperse swellings, act as a tonic and diuretic, and increase the flow of bile. The juice of the root with milk is diuretic, antilithic and digestive, and is useful in asthma. A poultice made with the root reduces swellings, but is very irritating and painful to the skin. The pods are a wholesome vegetable, and act as a preventive against intestinal worms (*vide* Makhzan, article Sahjna). Ainslie mentions the use of the Morunghy root by Europeans as a substitute for Horseradish. He also says that the native doctors prescribe it as a stimulant in paralytic affections and intermittent fever in doses of about one scruple; that they also employ it in epilepsy and hysteria, and consider it a valuable rubefacient in palsy and chronic rheumatism. He wrongly supposes the seeds to be the Hab-el-bán of the Arabians. Rumphius and Loureiro state that the bark is emmenagogue and even abortifacient. In Bengal half-ounce doses of the bark are said to be used to procure abortion. In Madras the following prescription is said to be a good remedy for scorpion stings:—Moringa bark and nut of each 4 ozs., tobacco 2 ozs., gunpowder 2 drachms. Make into a smooth paste, roll into a pencil and dry. When required rub it with a little water over the sting. According to Fleming, the oil of the seeds is used as an external application for rheumatism in Bengal. In India the root is generally accepted by Europeans as a perfect substitute for Horseradish. The unripe pods are used as a vegetable; they may

be boiled and served with melted butter, or cut in pieces and mixed with curries. The flowers are eaten in curries, and also fried with butter. The young leaves are boiled with onions and spices and used in the same manner. A decoction of the root bark is used as a fomentation to relieve spasm. In the Concan the bark of the wild tree is ground with Plumbago root, pigeon's dung, and chicken's dung and applied to destroy Guinea-worms. Four tolás of the juice of the leaves of the cultivated tree are given as an emetic. The gum is said to be used to produce abortion, but it is difficult to obtain any reliable evidence upon a point of this nature; it would be quite possible to use it as a tent to dilate the os uteri, as it is very tough, and swells rapidly when moistened. In many parts of India the right of collecting the pods upon Government lands, for sale as a vegetable, is leased; they are never allowed to ripen, and the oil is not expressed. The Bengal Pharmacopœia furnishes formulæ for a compound spirit and compound infusion. In the Pharmacopœia of India the plant is placed in the secondary list, and its principal uses are briefly noticed.

Description.—The fruit is light brown when ripe, a foot or more in length, triangular, ribbed, and composed of three valves containing a soft white pith, and a single row of from 12—18 seeds, which are dark brown, roundish, the size of a pea, and furnished with three membranaceous wings. The kernel is white, oily and bitter. The gum, when it first exudes, is opaque and white; from exposure to the air it soon becomes pink, and finally of a dull red colour on the surface, the interior remaining white. It occurs in pieces of considerable size, generally more or less vermicular in form, and appears to be only produced upon trees which have been injured by insects. The taste is bland and mucilaginous. In dry air the gum becomes very friable, but in a damp climate it is tough and holds 20 per cent. of its weight of water. The bark of the root has a reticulated light brown external surface; it is thick, soft, and internally white, and has a pungent odour and taste, exactly like Horseradish. The wood of the root is soft,

porous, and yellowish, and has the same properties in a less degree.

Microscopic structure.—The parenchyme cells of the bark are loaded with globules of essential oil. The wood is provided with very large scalariform vessels easily visible with the naked eye. The medullary rays both in the wood and bark are very distinct.

Chemical composition.—The root distilled with water yields an essential oil which appears to have much pungency, but the odour is distinct from that of oil of mustard and garlic, and more offensive. The husked seeds yield, according to Cloëz, 36·20 per cent. of oil. (*Compt. Rend.* LXI., p. 236.)

Moringa bark contains a white crystalline principle answering to the reactions of an alkaloid and occurring in the spirituous extract. It is scarcely soluble in water and ether, but readily soluble in acidulated water, alcohol and chloroform. Sulphuric acid dissolves it with a red-brown colour, nitric acid with a yellow colour. The bark also contains two resins, one soluble the other insoluble in ammonia, an organic acid, a quantity of mucilage, and it left on incineration 8·2 per cent. of carbonated ash. An alcoholic extract of 30 grammes of bark was administered to a small dog and produced no poisonous effects. The gum-like exudation when placed in water gradually disintegrates, forming a slimy mucilage which is precipitated white by solutions of neutral and basic plumbic acetate, and is not affected by alcohol, ferric chloride, oxalate of ammonia or borax. The insoluble portion is seen under the microscope to be composed of mucilage cells. No starch or tannin is present in the exudation. When holding 11 per cent. of water it has a specific gravity of 1·46 at 15° C. It absorbs 20 times its weight of nitric acid (1·2), forming an orange jelly which when heated is decomposed and produces oxalic acid. Ash 2·75 per cent.

LEGUMINOSÆ.

CROTALARIA JUNCEA, *Linn.*

Fig.—*Roxb., Cor. Pl. t.* 193; *Bot. Mag.* t. 1933; *Rheede, Hort. Mal. ix. t.* 26.

Hab.—Throughout the plains of India. Often cultivated.

Vernacular.—San (*Hind., Beng., Guz.*), Jenappa, Shanal (*Tam.*), Shanambo (*Tel.*), Sanvu (*Can.*), Tág, Sonalla (*Mar.*).

History, Uses, &c.—The seeds and leaves of this plant, in Sanskrit Sana, are used in Hindu medicine, and are considered to be cooling, and to purify the blood in febrile states of the system accompanied by cutaneous eruptions, such as impetigo, psoriasis, &c. They are also said to be emmenagogue in half drachm doses given twice a day, and are supposed sometimes to have caused abortion, but this is very improbable. The sacred thread of the Kshatrias is directed by Manu to be made of Crotalaria fibre.

C. verrucosa, *Linn., Bot. Mag. t.* 3034; *Wight, Ic. t.* 200; *Rheede, Hort. Mal. ix. t.* 29, found throughout the tropical regions of India, is called in Sanskrit Sana-pushpi, Dhavani, and Vrihat-pushpi; it is described in the Nighantas as bitter and an expellant of bile and phlegm. This plant and several other species of the genus are included under the Sanskrit name of Ghantarává and the vernacular names Jhanjhania (*Hind., Beng.*), Vatta-killu-killuppai (*Tam.*), Ghelegherinta (*Tel.*), Ghágri, Dingala, Khúlkhúl-dingala (*Mar.*), in allusion to the rattling noise made by the seeds when the ripe pods are shaken, just as the generic name of the botanists is derived from the Greek *κρόταλον*, a rattle or castanet. Rheede (*Hort. Mal. ix.* p. 53) says that the juice of the leaves of *C. verrucosa* is supposed to diminish salivation. Ainslie, speaking of the same plant, says:—"The slightly bitter, but not unpleasant tasted juice of the leaves and tender stalks is prescribed by the Tamool doctors, both internally and externally, in cases of scabies and

impetigo." In Pudukota, **C. retusa**, *Linn.* (*Bot. Mag. t.* 2561; *Rheede, Hort. Mal. ix. t.* 25), is used for the same purpose. **C. sericea**, *Retz.*, is used in Bengal, and **C. medicaginea**, *Lam.*, in the Punjab. **C. Burhia**, *Hamilt.*, called Khip, Sis and Kharsan in the vernaculars, is considered to be very cooling; it is a naked looking, bushy plant, common in the arid districts of Northern India, which has the smell of broom when bruised.

C. juncea is extensively cultivated for its fibres, from which tow is prepared. The nets of the Bombay fishermen are made of this fibre which is very strong and tans well. After the bark has been removed, the stems of the plant, which are perfectly straight and unbranched, are sold to the toy-makers; or cut in short lengths and dipped in brimstone to make fire-lighters for the Parsees, whose religion forbids them to blow fire when lighting or extinguishing it.

The Crotalarias appear to be used medicinally on account of their mucilaginous and emollient properties; the leaves might be used as a poultice like Althæa leaves.

Chemical composition.—Mr. J. G. Prebble, who has examined the leaves of *C. retusa* and *C. medicaginea*, informs us that they contain abundance of mucilage, a little solid fat, and a resin soluble in ether, which does not form a reddish solution with potash. The leaves of *C. medicaginea* contain also a trace of tannin.

TRIGONELLA FŒNUM-GRÆCUM, *Linn.*

Fig.—*Sibth., Fl. Græc., t.* 766; *Bentl. and Trim., t.* 71. Fenugreek (*Eng.*), Fenugrec (*Fr.*).

Hab.—Cashmere, Punjab, Upper Gangetic Plain. Widely cultivated. The seed and herb.

Vernacular.—Méthi (*Hind., Mar., Guz., Beng.*), Vendayam (*Tam.*), Mentula (*Tel.*), Menthya, Mente (*Can.*).

History, Uses, &c.—Fenugreek has a history of great antiquity; it was much valued by the ancients both as a food

and medicine; in India it has long been extensively cultivated, its seeds being considered carminative, tonic, and aphrodisiac. Several confections made with them are described in Sanskrit works under the names of *Methi modaka, Svalpa methi modaka,* &c., and are recommended for use in dyspepsia with loss of appetite, in the diarrhœa of puerperal women, and in rheumatism. All these preparations consist of a number of aromatic substances, one part each, and fenugreek seeds equal in quantity to all the other ingredients. Under the Arabic name of Hulbah, and the Persian Shamlit, Mahometan writers describe the plant and seeds as hot and dry, suppurative, aperient, diuretic, emmenagogue, useful in dropsy, chronic cough, and enlargements of the spleen and liver. A poultice of the leaves is said to be of use in external and internal swellings and burns, and to prevent the hair falling off. The flour of the seeds is used as a poultice, and is applied to the skin as a cosmetic. They also use the oil of the seeds for various purposes. In Europe the history of the plant is equally ancient. Aretæus prescribed it both internally and externally. The powder of the seeds was recommended by Dioscorides in the form of a poultice for inflammatory affections.* Pliny (24, 120) mentions the use of Fenugreek or Silicia as a medicine, and ascribes to it the same properties as the Mahometan writers above quoted. Ainslie notices its uses by native practitioners in Southern India for dysentery, the seeds being toasted and afterwards infused. At the present time, Fenugreek is extensively used in India both as an article of diet and as a medicine. The leaves are used both internally and externally on account of their cooling properties. The young plants are always to be found in the vegetable markets, and are most esteemed when only the two seed leaves are formed; they are boiled and afterwards fried in butter, the taste is strongly bitter, and disagreeable to those who have not become accustomed to it; in bilious states of the system the vegetable has an aperient action. The seeds enter into the composition

* It is the τῆλις of Dioscorides (ii., 93). Other Greek names are βούκερως, (oxhorn) and αἰγόκερως (goatshorn).

of an imitation of carmine. The yellow decoction used with sulphate of copper produces a fine permanent green. In modern medicine Fenugreek is no longer in use; it is, however, still kept by druggists for veterinary pharmacy, and is very largely consumed in the preparation of cattle foods.

Description.—The pod is sickle-shaped, 3—4 inches long, slightly flattened and ending in a long point; it contains from 10—20 rhomboidal seeds, yellow or yellowish-brown, semi-transparent, about ⅛ of an inch long, somewhat compressed, with the hilum on the sharper edge, and a deep furrow running from it and almost dividing the seed into two unequal lobes; the surface is finely tubercular; the testa consists of two layers, the inner of which is mucilaginous and encloses the cotyledons and their large hooked radicle. The cotyledons are composed of parenchymatous tissue, the cells of which contain globules of fatty matter, and granular matter coloured yellow by iodine; the taste is bitter, oily and aromatic.

Chemical composition.—The cells of the testa contain tannin; the cotyledons a yellow colouring matter, but no sugar. The air-dried seeds give off 10 per cent. of water at 100° C., and on subsequent incineration leave 7 per cent. of ash, of which nearly a fourth is phosphoric acid. Ether extracts from the pulverised seeds 6 per cent. of a fetid, fatty oil, having a bitter taste. Amylic alcohol removes in addition a small quantity of resin. Alcohol added to a concentrated aqueous extract, forms a precipitate of mucilage, amounting, when dried, to 28 per cent. Burnt with soda lime, the seeds yielded to Jahns 3·4 per cent. of nitrogen, equivalent to 22 per cent. of albumin. The nature of the odorous principle has not been determined. (*Pharmacographia.*) E. Jahns (*Bericht*, 18, 2518-2523) reports that he has found two alkaloids in the seeds, *choline*, a base found in animal secretions, and another, which he names *trigonelline*. The pulverised seeds were extracted with 70 per cent. alcohol, and after evaporation, the residual liquor was precipitated with lead acetate and soda. After removal of lead from the filtrate and evaporation, the alkaloids were precipi-

tated by potassium-bismuth iodide and sulphuric acid. The bases were only completely precipitated after some weeks, and were then converted into the mercuric iodide compounds to separate albuminous matter. This was done by decomposing the bismuth compound with soda and adding mercuric iodide, when *choline* was precipitated and *trigonelline* remained in the mother liquor, from which it was precipitated as oily drops (afterwards solidifying) by means of sulphuric acid —0·05 per cent. of choline and 0·13 per cent. of trigonelline were obtained. The author examined the gold and platinum salts of choline. Trigonelline, $C^7 H^7 NO^2 + H^2 O$, crystallises from alcohol in colourless prisms, which possess a weak saline taste. It is hygroscopic and easily soluble in water, but is insoluble in ether, chloroform, and benzol. The solutions are neutral. It gives precipitates with the usual alkaloidal reagents. Analyses of the free base, the hydrochlorate and the platinum and two gold double salts were made.

Trigonelline is isomeric and probably identical with pyridine-betäin, prepared by Von Gerichten by heating pyridine with monochloracetic acid, the only difference being that pyridine-betäin hydrochlorate is coloured blue by sodium amalgam, and trigonelline yellow. By heating trigonelline with concentrated caustic potash, a distillate is obtained which appears to contain pyridine. (*Journ. Soc. Chem. Ind., Journ. de Phar. et de Chim.*, 1886.)

Commerce.—Fenugreek seeds are grown extensively in the higher inland provinces of India. From Karachi alone the imports into Bombay are about 14,000 cwts. annually.

Value.—Rs. 43 to 50 per candy.

TRIGONELLA UNCATA, *Boiss.*

Hab.—Persia. The pods.

Vernacular.—Iklil-el-malik (*Arab., Ind.*).

History, Uses, &c.—The small crescent-shaped pods which are imported into Bombay from the Persian Gulf under this name are considered by Arabian writers to be the Meli-

lotus of Dioscorides.* The author of the Makhzan-el-Adwiya gives Málilotus as the Greek name and Giah-i-kaisar as the Persian. He goes on to say that "there are two kinds of melilot, both plants are much alike, but the fruit of one is crescent-shaped with small roundish seeds something like fenugreek, while the fruit of the other is much smaller and only slightly curved; both have an odour like fenugreek. The best fruit for medicinal purposes is hard, yellowish, white and aromatic, with yellow seeds." The Mahometans, following the Greeks, hold melilot in high esteem as a remedy in a great variety of disorders; it is considered to be suppurative and slightly astringent, and is much used as a plaster to dispel tumours and cold swellings. The diseases in which it is administered internally are of a widely different nature and far too numerous for recapitulation here; for an account of them we must refer the reader to the Makhzan, article Iklíl-el-malik. *Melilotus alba*, Lam., and *M. parviflora*, Desf., grow in India; the first species has the delicate odour of the European melilot. In the Makhzan an Indian variety of melilot is mentioned, which has very small fruit; it is called Pirang.† Coumarin, the odorous principle of melilot, when given to dogs in doses of 7 to 10 grains, produces great and even fatal depression, and in man doses of 30 to 60 grains occasion nausea, giddiness depression, vomiting and drowsiness. Köhler finds it to be a narcotic, which at first stimulates, but afterwards paralyzes the heart.

Description.—Small, sickle-shaped, greyish yellow pods with a beak slightly curved outwards, distance from base to apex ½ an inch; length of pod round the curve about one inch; it is grooved on both sides, and divided by a central partition

* μελίλωτος, Dios. iii., 43. Melilotus and Sertula campana of the Romans. Plin. 21, 29, much used in preparing malagmata, Scrib. Comp. 258, *et seq.*

† *Trigonella corniculata*, Linn., Wight Ic. t. 384. It is cultivated in Bengal as a vegetable in the cold weather, also at Belgaum, where it is called *Tirapa*. It is the Málya of Sanskrit writers, and is used in India for making chaplets.

into two cells, each of which contains a single row of small greyish-yellow rhomboidal seeds, deeply notched on one side, and seen under the microscope to be marked with numerous black spots. The other kind with very small slightly curved pods mentioned by Mahometan writers is not found in the shops.

Chemical composition.—Coumarin, $C^9 H^6 O^2$, the anhydride of coumaric acid, $C^9 H^8 O^3$, and the odorous principle of melilot, is found in several plants; it is best prepared from the Tonka bean, *Coumarouna odorata*, by digesting in strong alcohol, on evaporating, a crystalline magma is obtained, which when purified with animal charcoal is colourless; it crystallizes in trichlinic crystals; melts at 50° C., and boils at 270° without sensible alteration; it has an agreeable aromatic odour, and a bitterish burning taste, the vapour acts strongly upon the brain; coumarin is nearly insoluble in cold water, boiling water dissolves it freely, and deposits it on cooling in slender needles. It dissolves without alteration in dilute acids.

Commerce.—Iklil-el-malik is sold for six annas per lb.

INDIGOFERA TINCTORIA, *Linn.*

Fig.—*Rheede, Hort. Mal. i., t.* 54; *Wight Ic. t.* 365. Dyer's Indigo (*Eng.*), Indigotier tinctorial (*Fr.*),

Hab.—Western India, cultivated elsewhere. The plant and Indigo.

Vernacular.—Nil (*Hind., Beng.*), Nili (*Mar., Can.*), Nilam (*Tam.*), Nili-mandu (*Tel.*), Gali (*Guz.*).

History, Uses, &c.—Indigo, in Sanskrit Nila, a word which signifies dark blue or black, appears to have been known in the East as a dye and medicine from a very remote period. Its importance as an article of trade is indicated by the Sanskrit synonym Banigbandhu, or "trader's friend." It was probably exported from Cambay, Broach and Thana at a very early period, certainly from the latter port B. C. 30. What

Dioscorides calls Indicon, and Pliny and Vitruvius Indicum, was a blue pigment brought from India, and used both in painting and dyeing. When powdered it gave a black powder, and when suspended in water it produced an agreeable mixture of blue and purple. It belonged to the costly dye-stuffs, and was often adulterated by the addition of earth. On this account, that which was soft without any roughness, and which resembled an inspissated juice, was esteemed the best. Both Pliny and Dioscorides speak of two kinds, one of which adheres to reeds, in the form of slime or scum thrown up by the sea; the other was scraped from the sides of dye-pans in the form of a purple-coloured scum. The ancients considered Indicum to be astringent, and used it for ulcers and inflammation, and to cleanse and heal wounds. (See Beckmann's Hist. of Invent. II., p. 258, where the subject is fully discussed.) The early Arabian physicians identified Indicum with Nil, which they regarded as a kind of Indian woad. Ibn Sina calls it El-wasmah-el-Hindiya, and it was also called Idlim, which was an Arabian name for woad, as appears from a passage in Abu Hanifeh, who says:—"An Arab of the desert, of the Saráh tribe, told me that the Idlimeh is a plant that rises upon a stem about a cubit in height, and has branches at the extremities of which are what resemble the blossoms of the coriander, and it (the plant) is dust-coloured." In Ibn Sina's time woad appears to have been superseded by indigo, as he describes wasmeh as wark-un-nil, "or leaves of the Nil." In the 13th century, Marco Polo relates that he saw Indigo, which the dyers used, made in the kingdom of Coulan or Coilum; and he describes the process for preparing it. Persian writers on Indian drugs state that before the time when the English began to cultivate indigo, the best kind made in India was known as Baiana, from the name of a place in the Shahjehanabad district where it was made, and the record of the cargoes of the ships which arrived in Holland from the East Indies in 1631, show that the first had 13,539 lbs. of Sirches indigo; the second 82,734 lbs. of Guzerat indigo; the third 66,996 lbs. of the same; the fourth 50,795 lbs. of *Bajana*

indigo; the fifth 32,251 lbs. of Sirches indigo; the sixth 59,698 lbs. of *Bajana* indigo; and the seventh 27,532 lbs. of Sirches. The value of the indigo brought in these ships was at least 500,000 dollars.

The indigo plant was not known in Europe until the close of the 16th century.

Both Hindus and Mahometans consider the plant to have attenuant properties; they prescribe it in whooping-cough, affections of the lungs and kidneys, palpitation of the heart, enlargement of the spleen or liver and dropsy. Indigo applied to the navel of children is said to act upon the bowels; it is applied to the hypogastrium to promote the action of the bladder.

A poultice or plaster of the leaves is recommended in various skin affections, and is used as a stimulating application to old ulcers, haemorrhoids, &c. Indigo is applied to the bites and stings of venomous insects and reptiles to relieve the pain, also to burns and scalds, and in Bengal is commonly applied to wounds, &c., of horses and cattle.

The plant has a great repute in some parts of India as a prophylactic against hydrophobia, so much so as to be known among the natives as "*the dog-bite shrub.*" A wineglassful of the juice of the leaves is administered in the morning, with or without milk, for three days, to those who have been bitten by dogs supposed to be mad. People who have taken it inform us that beyond slight headache no disagreeable effect is produced, but that when a larger dose has been given it has proved purgative. In addition to the internal administration, the expressed leaves are each day applied to the bitten part as a poultice. Rheede, speaking of indigo, says—"viribus veneni obsistit." Ainslie notices the use of the root by the Hindus in hepatitis. It would appear that the wild indigo (*I. paucifolia*, Delile,) is considered to have the same medicinal properties as *I. tinctoria* and its variety *I. anil*. For Roth's observations on the use of Indigo in epilepsy and other spasmodic affections, see *Brit. and For. Med. Rev.*, July 1836, p. 244. His account

of its physiological effects is as follows :—"Shortly after taking it, the patient experiences a sense of constriction at the fauces, and the impression of a metallic taste on the tongue. These are followed by nausea, and frequently by actual vomiting. The intensity of these symptoms varies in different cases. In some the vomiting is so violent as to preclude the further use of the remedy. The matter vomited presents no peculiarity except its blue colour. When the vomiting has subsided, diarrhœa usually occurs: the stools are more frequent, liquid, and of a blue or blackish colour. The vomiting and diarrhœa are frequently accompanied by cardialgia and colic. Occasionally these symptoms increase, and the use of the remedy is in consequence obliged to be omitted." Dyspepsia and giddiness sometimes succeed. The urine has a brown, dark, violet colour; but Dr. Roth never found the respiratory matter tinged with it. After the use of indigo for a few weeks, twitchings of the muscles sometimes were observed, as after the use of strychnia. The seeds of these plants powdered and steeped in arrack or rum, yield a tincture which is used to destroy lice.

Cultivation and production.—Indigo is chiefly cultivated in Bengal in the delta of the Ganges, on those districts lying between the Hooghly and the main stream of the former river. The ground is ploughed in October and November after the cessation of the rains; the seeds are sown in March and the beginning of April. In July the plants are cut when in blossom, that being the time when there is the greatest abundance of dyeing matter. A fresh moist soil is the best, and about 12 lbs. of seeds are used for an acre of land. The plants are destroyed by the periodical inundations, and so last only for a single year. The cut plants are first steeped in water, when they ferment with evolution of CO^2, the yellow liquor is then run off into another vat, when it is vigorously mixed with air by manual labour or machinery. By this means the leucindigo (white indigo) contained in the solution is oxidised, and the indigo separates out as a blue scum which finally settles to the bottom. The supernatant liquor is then run off, and the indigo is boiled with water for several hours, pressed and

dried. (*Watts' Dict. of Chem.*) Before it is perfectly dry it is cut into cubes three inches square; it is then packed up for sale. Indigo is one of the most precarious of Indian crops, being liable to be destroyed by insects as well as inundation of the rivers. It is generally divided into two classes, *viz.*, Bengal and Oude indigo. Madras indigo is not much inferior to that grown in Bengal.

Description.—A shrub 2 to 3 feet, erect, pubescent; branches terete, firm; leaves pinnated; leaflets 5 to 6 pairs, oblong ovate, cuneate at the base, slightly decreasing in size towards the apex; racemes shorter than the leaves; sessile, many flowered; flowers small, approximated at the base of the raceme, more distant and deciduous towards the apex, greenish rose-coloured; calyx 5 cleft; segments broad, acute; legumes approximated towards the base of the rachis, nearly cylindrical, lightly torulose, deflexed and curved upwards; seeds about 10, cylindrical, truncated at both ends.

Chemical composition.—The formation of leucindigo from the glucoside indican, which is present in the plant, is stated by E. Alvarey (*Compt. Rendus.* 105, 286) to be effected by a special bacillus, which is strongly pathogenic, and closely resembles the bacilli of pneumonia and rhinoscleroma (*Watts' Dict. of Chem.*) Regarding the preparation of indigo synthetically by Baeyer, and for an account of the chemistry of the article, we would refer our readers to Muir and Morley's edition of Watts' *Dictionary of Chemistry*. Pure indigo should yield about 4·5 per cent. of ash.

Commerce.—There are many kinds of indigo in the Indian market; the principal are:—

Calcutta	Value	Rs.	60	to	110	per maund of 41 lbs.		
Madras	,,	,,	40	,,	105		,,	,,
Hawudi	,,	,,	55	,,	66		,,	,,
Kheirpuri	,,	,,	38	,,	50		,,	,,
Multanilál	,,	,,	35	,,	50		,,	,,
Kánpúr	,,	,,	30	,,	50		,,	,,
Deráni Jámpúr...	,,	,,	20	,,	32		,,	,,

The present annual production of indigo is estimated as about 8,200 tons (valne £ 4,000,000), of which 6,100 tons are produced in India, 1,100 tons in America, and 1,000 tons in China and other countries. (*Watts' Dict. of Chem.*)

INDIGOFERA ASPALATHOIDES, *Vahl.*

Fig.—*Wight Ic., t.* 332 ; *Hook. Ic., t.* 188.

Hab.—Carnatic and Ceylon. The plant.

Vernacular.—Shenevar-vaymbu (*Tam.*), Shiva-nimb (*Mar.*).

History, Uses, &c.—This plant is the Manelli of Rheede (*Hort. Mal. ix.*, 37) and the *Aspalathus indicus* of Ainslie. Rheede states that the plant, rubbed into a paste with butter, is applied to reduce œdematous tumours, and that a preparation made from the ashes of the burnt plant is used to remove dandriff from the hair; the leaves are applied to abscesses, and an oil is prepared with the root which is used to anoint the head in erysipelas. According to Ainslie, the leaves, flowers, and tender shoots are considered to be cooling, demulcent, and alterative, and are employed in decoction in leprosy and cancerous affections. The root is chewed as a remedy for toothache and aphthæ of the mouth.

Description.—A low undershrub, with many spreading, rigid, terete branches, and argenteo-canescent branchlets. Leaflets 1 to 5, pale green, with a few obscure adpressed hairs, oblong-lanceolate, $\frac{1}{12}$ to $\frac{1}{4}$ in. long, often complicate. Pedicels erecto-patent, $\frac{1}{8}$ to $\frac{1}{4}$ inch. Corolla pale red. Pod straight, glabrous, turgid, $\frac{1}{2}$ to $\frac{5}{8}$ in. long, 6 to 8 seeded. (*Fl. Brit. Ind.*)

Indigofera paucifolia, *Delile.* Kuthekar, Summattee (*Tam.*), is a rare shrub, the leaves of which are covered with a hoary pubescence. Dr. P. S. Mootooswamy informs us that it is used for rheumatic affections, and that the native physicians consider it to be antiphlogistic, antisyphilitic, and deobstruent. The whole plant is cut in small pieces and stewed for several days in the oven, and the resulting decoction is used to foment

the joints, and a dose of from 3 to 4 ounces is administered internally twice a day. A decoction of the root is also used as a remedy for periostitis. It is made with 2 ounces of the powdered root and 10 ounces of water boiled down to one half. Dose 1 to 2 ounces.

Indigofera enneaphylla, *Linn., Wight. Ic., t.* 403; *Burm. Fl. Ind., t.* 55, *f.* 1. Kennegilu (*Can.*), Adambedi (*Tam.*). According to Ainslie, the juice of this plant is given as an anti-scorbutic, alterative and diuretic. It is called Bhui-guli in Marathi.

Indigofera trifoliata, *Linn., Wight Ic., t.* 314. The seeds, which are oblong, about $\frac{1}{16}$ of an inch long, polished, yellowish and marked with minute dull red blotches, are prescribed along with other mucilaginous drugs as a restorative. They are called Vekário in Guzerathi.

PSORALIA CORYLIFOLIA, *Linn.*

Fig.—*Burm. Fl. Ind., t.* 49; *Bot. Mag., t.* 665.

Hab.—Himalaya to Ceylon. The seeds.

Vernacular.—Bukchi, Bábachi (*Hind.*), Bavachi (*Mar.*), Latakasturi (*Beng.*), Karpo-karishi (*Tam.*), Bhavanchi-vittulu, Káru-bogi vittulu (*Tel.*)

History, Uses, &c.—Sanskrit writers mention a plant called Lata-kasturika or Lata-kasturi as growing in the Deccan; it has been supposed by most modern writers on Indian Materia Medica to be the Musk Mallow; but as that plant does not grow in the Deccan, and *P. corylifolia* is very common there and is known in Bengal as Lata-kasturi, we think it probable that it is the plant alluded to, especially as the seeds are used in making a perfumed oil which is applied to the skin. Native works on Materia Medica describe the seeds as hot and dry, or according to some, cold and dry, lenitive, fragrant, stimulant and aphrodisiac. They are recommended in leprosy, and other chronic skin diseases which depend upon

a vitiated state of the blood, and are given internally and applied externally as a plaster; whence the synonym Kushta-násini; they are also said to be useful in febrile bilious affections and as an anthelmintic and diuretic. The Hindus class them with the रसायन (*rasáyán*) or alchemic drugs. Ainslie mentions their use in Southern India as a stomachic and deobstruent, and says that they are prescribed in lepra and other inveterate cutaneous affections. Some years ago the seeds were extensively tried in Bombay by Dr. Bhao Dáji and others, as a remedy in leprosy, with some success.

Dr. Kanny Loll Dey strongly recommends the oleo-resinous extract of the seeds diluted with simple unguents as an application in leucoderma. He says :—" After application for some days the white patches appear to become red or vascular; sometimes a slightly painful sensation is felt. Occasionally some small vesicles or pimples appear, and if these be allowed to remain undisturbed, they dry up, leaving a dark spot of pigmentary matter, which forms as it were a nucleus. From this point, as well as from the margin of the patch, pigmentary matters gradually develope, which ultimately coalesce with each other, and thus the whole patch disappears. It is also remarkable that the appearance of fresh patches is arrested by its application." (*Phar. Journ., Sept. 24th,* 1881.) In the hands of other observers, however, only negative results have been obtained by this mode of treatment.

Several species of Psoralia have been used medicinally in America, and have been found to act as gentle, stimulating, and tonic nervines. (For an interesting account of the American Psoralias, see Maisch., *Amer. Journ. Pharm., July* 1889.)

Description.—The seeds are oblong and flattened, rough, dark brown, about 2 or 2¼ lines in length; they are unctuous to the touch, and have an agreeable aromatic odour exactly resembling that of the bael fruit and very similar to elemi; the taste is aromatic and bitterish.

Chemical composition.—The seeds reduced to fine powder and heated to 100° C. for 5 hours lost 5·01 per cent. in weight,

but the powder still possessed the aromatic odour of the drug. The ash amounted to 7·41 per cent.; it contained a trace of manganese. On distilling the powdered seeds with water, a colourless oil was obtained, lighter than water, and which possessed in a very marked degree the odour of the seeds. The powdered seeds digested with light petroleum ether yielded 13·26 per cent. of a dark amber-coloured, thick non-crystalline extractive, which had a strong odour of the drug. By the action of cold 96 per cent. alcohol the extract was separated into a portion soluble in alcohol and an insoluble residue. The insoluble residue consisted of yellow oily matter which could be easily saponified with alcoholic potash. The portion soluble in alcohol was of a dark, reddish colour, and the alcoholic solution had a marked acid reaction. After driving off the alcohol the soft extract was treated with caustic soda and agitated with ether. The ethereal solution left on evaporation an oily reddish non-crystalline residue, with a somewhat sweet taste. The aqueous alkaline solution was treated with hydrochloric acid in slight excess, which threw down a yellow precipitate, and the solution agitated with light petroleum ether. With the exception of a few brown flocks, the precipitate produced by the acid was wholly dissolved by the petroleum ether. On spontaneous evaporation of the ether a bright yellow oily residue was left; taste somewhat bitter like that of the seeds. This oily residue was soluble in alcohol; on spontaneous evaporation small needle-shaped crystals separated. Ferric chloride added to an alcoholic solution produced a dark brown coloration. After the action of light petroleum ether, ether extracted 7·1 per cent. of a reddish-yellow hard varnish-like extract with a very faint odour of the seeds; easily soluble in alcohol with neutral reaction, insoluble in water, or in dilute hydrochloric acid; partly soluble in aqueous ammonia, but easily soluble in dilute caustic soda, forming a dark, reddish solution. The addition of acids caused the precipitation of yellow flocks; an alcoholic solution was coloured dark brown by ferric chloride. After exhaustion of the powdered seeds with ether, absolute alcohol yielded 6·12 per cent. of extractive, partly soluble in

water, with acid reaction and yellow colour. The portion insoluble in water was of a dark colour. The addition of dilute H Cl to the aqueous solution caused the precipitation of yellow flocks. The solution filtered from these yellow flocks gave a slight precipitate with phosphomolybdic acid, but no reaction with other alkaloidal reagents. The addition of alkalies deepened the tint of the solution, but no tannin reaction could be obtained.

To cold distilled water, the residue after the action of absolute alcohol yielded 19·34 per cent. of extractive which contained albumen, sugar, &c., and a trace of an organic acid.

TEPHROSIA PURPUREA, *Pers.*

Fig.—*Rheede, Hort. Mal. i., t.* 55; *Bert. Misc. xix.*, 9, *t.* 5. Purple goat's rue (*Eng.*), Tephrosia pourpre (*Fr.*).

Hab.—Tropical zone. The plant.

Vernacular.—Sarphunkha, Sarpunkha (*Hind., Guz.*), Bon-nil-gachh (*Beng.*), Unhâli (*Mar.*), Kolluk-kay-velai (*Tam.*), Vempali (*Tel.*).

History, Uses, &c.—Sarapunkha, the Sanskrit name of this plant, is a compound of शर, an arrow, and पुंख, the pinion of an arrow, in allusion to the pinnate leaf of the plant. Native works on Materia Medica describe it as hot and moist, some say cold; it is considered to be deobstruent and diuretic, useful in cough and tightness of the chest, bilious febrile attacks, obstructions of the liver, spleen, and kidneys; they recommend it as a purifier of the blood, and for boils, pimples, &c. Mir Muhammad Husain describes the plant minutely, and mentions its use in combination with *Cannabis indica* leaves (bhang), two parts of the former to one of the latter, in powder, as a remedy for bleeding piles; given with black pepper he says it is diuretic, and especially useful in gonorrhœa. Ainslie says the root of *Galega purpurea* is prescribed by the native practitioners of Southern India in decoction in cases of dyspepsia and tympanitis, and we have noticed a similar use of the plant

in Western India. *T. purpurea* is a common weed in the rainy season; the whole plant is pulled up when in flower and seed, and tied in bundles of about a handful for sale. In Pudukota the juice of the leaves of **T. villosa** (Vaykkavalai in Tamil) is given in dropsy. In America the roots of *T. virginiana*, Pers., are considered to be laxative, tonic and vermifuge, and have also been reported to be useful in typhoid fever; a decoction made with an ounce of the plant to a pint of water and boiled down to one half, has been used in doses of one to two tablespoonfuls. (*Stillé and Maisch.*)

Description.—A shrubby, erect, much-branched plant about 2 feet high; leaves pinnated; leaflets 5 to 9 pairs with an odd one, the largest an inch long, and 3-10th of an inch broad, cuneate oblong; racemes peduncled, longer than the leaves; legumes slightly compressed, spreading, linear falcate, obtuse, with a short point; seeds 4 to 6 in each pod, small, kidney-shaped; testa mottled; cotyledons yellow. All parts of the plant are slightly bitter.

Chemical composition.—The whole plant, with seeds, pods, but no roots, dried by exposure to air and reduced to fine powder, lost 8·44 per cent. when heated to 100° C. The ash amounted to 6·07 per cent., and contained a trace of manganese.

The petroleum ether extract amounted to 2·88 per cent., and consisted of chlorophyll, a resin and a trace of wax. Ether extracted 1·05 per cent., the extract consisted chiefly of a brown resin and chlorophyll. Treated with dilute hydrochloric acid a trace was dissolved. No reactions were afforded by alkaloidal reagents.

The absolute alcohol extract amounted to 2·36 per cent., on spontaneous evaporation yellowish nodules separated; these were washed with cold alcohol, and then dissolved by boiling alcohol. On evaporation, a sulphur-yellow powder and crusts separated, which examined microscopically, consisted of needle-shaped crystals. These crystals were soluble in boiling water, but practically insoluble in cold water, alcohol or ether; ferric-chloride gave a green colouration in an aqueous solution,

which turned dirty red on boiling. In alkalies these crystals were soluble, the solution being of a bright yellow colour; acetate of lead gave a bright yellow precipitate; an aqueous solution had an acid reaction, and at once reduced nitrate of silver. This principle would appear to be allied to quercitrin or quercetin. The absolute alcohol extract treated with acidulated water did not give any reaction with the usual alkaloidal re-agents.

Cold water extracted 14·20 per cent., the extract contained gum, a trace of albumin and colouring matter, but did not reduce an alkaline solution of sulphate of copper.

Mundulea suberosa, *Benth., Bedd. Fl. Sylv.* 85; *Hook. Ic. Plant., t.* 120, Syn.—*Tephrosia suberosa,* is a stout, erect shrub growing in hill valleys in the Western Peninsula and Ceylon. It is frequently cultivated in gardens on account of its beautiful rose-coloured flowers, which form terminal racemes. The leaves resemble Senna leaves. The seeds are used in Southern and Western India as a fish poison. They stupefy the fish, which are then readily taken by the hand.

The pods are about 4 inches long, straight, silky, contracted between the seeds, with both sutures thickened so as to form prominent borders; seeds 6 to 8, kidney-shaped, laterally compressed, about $\frac{3}{6}$ in. in length and $\frac{2}{6}$ in. in breadth, of a pale dull yellow colour. Beneath the thick, fissured, soft corky bark of the stem is a compact inner bark of a green colour, which has a bitter taste and has the same effect upon fish as the seeds.

Mundulea seeds and bark contain a greenish yellow resin soluble in carbon bisulphide, benzol, chloroform, amylic alcohol, ether, hot alcohol, and partly in caustic alkalies with a bright yellow colour.

The leaves contain besides the resin an organic acid and 9 per cent. of ash.

ALHAGI MAURORUM, *Desv.*

Fig.—*Jaub. & Spach. Ill., t.* 401. Camel thorn (*Eng.*), Alhagi Manne (*Fr.*).

Hab.—N.-W. Provinces, Upper Gangetic plain and Concan. The plant and manna.

Vernacular.—The plant, Jawása (*Hind.*), Javaso (*Guz.*), Giri-karmika (*Tel.*); the manna, Taranjabin.

ALHAGI CAMELORUM, *Fisch.*

Hab.—Khorasan. The Manna.

Vernacular.—The plant, Khár-i-buz, Khar-i-shutr (*Pers.*); the manna, Taranjabin.

History, Uses, &c.—These plants, in Sanskrit Durálabha (difficult to be laid hold of), in Persian Khár-i-buz or Khár-i-shutr, and in Arabic Háj, or Algoul, are natives of the deserts of Egypt, Syria, Mesopotamia, Persia, and India as far south as the Concan, and have been supposed by some to be the Occhi of Pliny, and the ἄκάνθά ἐν 'Αρία or 'Khorasan Thorn' of Theophrastus.* Mahometan writers give Farákiyun or Atháriyun as the Yunáni names, both evidently post-classical; the first appears to be derived from φέρω to bear and ἀκή, a a point or dart, and the second from ἀθήρ a spike or spine. A Persian manna probably obtained from these plants is mentioned by Polyænus, A. D. 163, under the name of ὔον μέλι.

In the hot season when all the smaller plants die they send forth leaves and flowers. The generic name is derived from the Arabic Al-hàju, which is pronounced by the Egyptian Arabs El-hágu. The plants are described in Sanskrit works as laxative, diuretic and expectorant, the thorny flower stalks and branches being the parts used. An extract obtainable by evaporating a decoction of *A. Maurorum* is called Yávasakará; it has a bitter sweet taste, and is used as a demulcent in coughs. There is no mention in Sanskrit books of manna being obtained from the plant; indeed none is produced upon it in India. The Hindus use the fresh juice as a diuretic, generally in combina-

* ἐν δέ τη 'Αρία χώρα καλουμένη ἄκανθά ἐστιν ἐφ' ἧς γίνεται δάκρυον ὅμοιον τῇ σμύρνῃ και τῇ ὄψει καί τῇ ὀσμῇ. τοῦτο δὲ ὅταν ἐπιλάμψῃ ὁ ἥλιος καταρρεῖ —*Hist. Plant.* iv. 4.

tion with laxatives and aromatics. (Cf. *Sarangadhara and Chakradatta.*) In Mahometan works, under the names of Háj and Khár-i-shutr, or camel thorn, a description of the plants will be found. They are considered to be aperient, attenuant and alexipharmic. A poultice, or fumigation with them is recommended to cure piles, the expressed juice is applied to opacities of the cornea, and is directed to be snuffed up the nose as a remedy for megrim. An oil is prepared with the leaves as an external application in rheumatism; the flowers are applied to remove piles. Ainslie notices *A. Maurorum* as one of the sources of manna. In the Bengal Dispensatory and Pharmacopœia of India it is also noticed on this account. Under the name of Taranjabín Mahometan writers describe Alhagi manna. Mir Muhammad Husain says that it is collected in Khorasán, Mawarunnahr, Kurjistan, and Hamadan by cutting the plants and shaking them in a cloth to separate the manna. According to Aitchison the country round Rui-Khauf is famous for this manna. An inferior kind is made by dissolving what still adheres in water and evaporating it to a suitable consistence. He describes it as aperient and cholagogue, more digestible than *Shirkisht*, expectorant, a good purifier of the blood from corrupt and adust humours when given in diet drinks such as barley water, &c.; diuretic, and with milk, fattening and aphrodisiac. In Bombay fine clean white samples of Taranjabin are sometimes obtainable during the season of import (November to January), but unless very carefully preserved it soon spoils in the moist climate of the Western Coast, running together, and becoming a brown sticky mass. The dried plant of *A. Maurorum* is always obtainable under the name of Jawása, and the ripe fruit with manna adhering to it under the name of Taranjabín. In the Concan the plant is smoked along with Black Datura, Tobacco, and Ajwán seeds as a remedy for asthma.

Description.—*A. Maurorum* is a low shrub, armed with copious subpatent hard pungent spines, ½ to 1 inch long; leaves simple, drooping from the base of the spines or branches, oblong

obtuse, rigidly coriaceous, glabrous; flowers 1 to 6, from a spine or on short pedicels; calyx glabrous, $\frac{1}{12}$ to $\frac{1}{8}$ inch; corolla reddish, three times the length of the calyx; pod, 1 inch long or less, falcate or straight, constricted between the seeds; seeds kidney-shaped, greenish grey, very hard.

Taranjabín occurs in white grains or small agglutinated masses, mixed more or less with the thorns, pods, and leaves of the plant; it has hardly any odour; the taste is saccharine and afterwards slightly acrid.

Chemical composition—According to Villiers (*Compt. Rend.*, lxxxiv., 35), Alhagi manna after being boiled with animal charcoal, and evaporated to a syrup crystallized after some months in small brilliant crystals, which on crystallization from alcohol formed large white crystals of the formula $C^{12}H^{22}O^{11}+H^2O$. It is dextro-rotatory, its power being $+94°48'$, or for the sodium flame, $+88° 51'$. On boiling with an acid, it is converted into glucose, and its rotatory power is reduced to that of glucose, *viz.*, +53. It then reduces Fehling's solution; nitric acid oxidizes it to mucic and oxalic acids. Its melting point is 140°. It is thus seen to be identical with Berthelot's melezitose. It crystallizes in monoclinic (clinorhombic) prisms. The mannite of Alhagi also contains cane sugar, which may be isolated by treating the mother liquor of the melezitose with alcohol, and adding ether till a slight precipitate is formed. Crystals of cane sugar are then deposited. The mother liquor acts like a solution of cane sugar containing dextro-rotatory foreign substances which are not fermentable with beer-yeast. (*Journ. Chem. Soc. April,* 1877.)

Commerce.—The plant is collected in India. The manna is imported from Persia in skins and bags. Value, about 10 annas a pound.

FLEMINGIA GRAHAMIANA, *W & A.*

Hab.— Nilgiris, S. Koncan, Canara. The glands from the pods.

Vernacular.—Wars (*Arab.*).

History and Collection.—The plant yielding these glands is a small under-shrub. Mr. Lawson, the Government botanist in Madras, who has studied the genus Flemingia, concludes that it is not specifically distinct from *F. rhodocarpa*, Baker. The fact that the plant grows in Arabia and is the source of the substance known as Wars, which first attracted attention in Europe in 1867, remained unknown until 1884, when specimens were sent home by the British Resident at Aden. On the northerly slopes of the Nilgiri plateau, the fruits ripen in November, towards the close of the north-east monsoon, when they are covered with the peculiar garnet-coloured glands. The drug is collected by cutting off the clusters of pods from the ends of the branches and laying them in the sun to dry for one or two days. They are placed upon boards or paper, as during the process of drying much of the powder falls, and would be lost unless such a precaution were taken. The pods are then pressed or rubbed together by hand over sieves. The powder is mixed with hairs, stones and pieces of stalk; it is readily removed from these impurities by finally passing it through a fine muslin or lawn sieve. Although the plant occurs pretty frequently in Southern India, very little seems to be known by the natives of its colouring or medicinal properties, and from enquiries made of Canarese traders north of the Nilgiris and Tamil people to the south, no information could be gleaned of its glands being a marketable article; but at a recent Exhibition of the Agri-Horticultural Society at Madras, some of the powder was shown by a native dyer.

Characters and Tests.—Wars is a granular, mobile powder of a deep purplish-red colour, and without any marked odour or taste. Under the microscope it is in the form of cylindrical or subconical grains with oblong resin-cells arranged in stories in the interior. The powder ignites like lycopodium when thrown into the flame of a lamp. The specific gravity is 1·37. It is insoluble in cold water; when mixed together it at first floats on the surface, and if left in contact, it slowly becomes wetted and sinks. If, however, it is rubbed up in a mortar before being added to the water, or if it is boiled in it, the

glands become broken and a bright yellow emulsion is formed; if this emulsion is allowed to stand, the resinous matter will subside and leave a yellow sweetish solution. The greater portion of Wars is dissolved by ether and warm alcohol, the resulting solution being of a bright orange-red colour; when treated with caustic alkalies the solution is intensely red. It sinks in oil of turpentine, imparting a slight colour to it after a time. When rubbed up in a mortar with water and the mixture submitted to distillation, an odour between that of caraway and lemon was observed in the distillate, and a greasy film in the receiver indicated traces of volatile oil as its source. Heated in a crucible, it at first blackened, giving off aromatic vapours, then intumesced and evolved inflammable gases which burnt with a smoky flame; when the charred mass was destroyed by prolonged ignition, a residue was left of a gray-coloured ash consisting mainly of finely divided sand.

Chemical composition.—The resinous colouring matter which constitutes the chief part of Wars has a brittle consistence when observed in thin strata. It is soluble in ether, alcohol, benzol, chloroform, carbon disulphide, acetic acid, and in solutions of potash, soda, ammonia, and their carbonates. It forms soluble compounds with lime and magnesia. It is precipitated from its solutions in the alkalies by acids in an apparently unaltered condition. Sulphuric acid dissolves it in the cold. Heated with nitric acid it rapidly oxidizes, yielding yellow-coloured products and a resin soluble in alcohol. A solution in spirit is partially precipitated by acetate of lead. Diluted alcohol appears to separate it into two resins; a soluble one of a yellow colour, and an insoluble one of a deep red. Heated with potash or soda an odour of citron is evolved. An ethereal solution of the resin allowed to evaporate spontaneously deposits a mass of crystals. The crystals are of a lighter colour than that of the surrounding red resin; examined microscopically, they appear as crops of acicular prisms radiating from a common centre. Ether and other liquids were added with a view to remove the crystals from the resin or *vice versa*; but all the volatile solvents tried resulted in forming a

solution of both, and this rendered the separation an insuperable difficulty.

Wars and Kamala compared :—

	Wars.	Kamala.
Resinous colouring matter............	72·83	78·19
Albuminous matter, &c................	8·20	7·34
Cellulose	9·50	7·14
Water....................................	3·44	3·49
Ash (principally sand)	6·03	3·84
Volatile oil	trace	trace
	100·00	100·00

As a dye the colouring matter of Wars is less in quantity and inferior in quality to that of Kamala. Medicinally, it is used by the Arabs to cure scaly eruptions of the skin. (*See Kamala.*)

FLEMINGIA TUBEROSA, *Dalz.*

Hab.—The Concan.

Vernacular.—Birmova (*Mar*).

History, Uses, &c.—A small trailing herb common in grassy places after the rainy season; it has trifoliate leaves studded with minute golden glands, and bears small purple pea-like flowers; the pods contain a single black seed which is almost round. The tuberous roots are eaten by the country people either raw or roasted, and are considered useful as a remedy for dysentery and leucorrhœa. As a remedy for the latter affection, the native Christian women stew them in wine or country liquor, but they appear to be equally, if not more, efficient when taken raw. At the country fairs and markets the tubers are often offered for sale at the end of the rainy season, in small baskets containing a pound or so each.

Description.—The tubers are ovoid-oblong, tapering to a point at the lower end, from two to two and a half inches in length; the outer skin is of a dark-brown colour and is easily removed by friction, exposing a smooth white surface. When

injured the tubers exude a sticky juice, which on hardening becomes red and translucent. The taste is sweet and astringent. When roasted or boiled, the tubers lose much of their astringency, and taste like roasted chestnuts.

Chemical composition—

Yellow resin soluble in ether	1·64
Sugar and gum	25·47
Asparagin	4·13
Albuminoids	13·04
Tannin	trace.
Starch	40·12
Cellulose	12·16
Ash	3·44
	100·00

The yellow pigmental resin gave a blood-red colour with sulphuric acid, dissolved with red solution in alkalies, and was reprecipitated in yellow flocks by acids and green with ferric chloride. The dried tubers afforded 2·47 per cent. of nitrogen.

PUERARIA TUBEROSA, *DC.*

Fig.—*Wight Ic. t.* 412.

Hab.—Western Himalaya, tropical zone. W. Peninsula, Orissa.

Vernacular.—Sural, Siali (*Hind.*), Dári, Gúmodi (*Tel.*), Debrelara (*Paharia*).

History, Uses, &c.—Roxburgh remarks that the root is an immense tuber, with acrid properties, and that it is used as a cataplasm to reduce swellings of the joints. O'Shaughnessy says that it is a native of the Punjab, and Cleghorn states that the tubers are exported to the plains. It may possibly be the Shurava of Sanskrit writers.

Description.—The tubers of *P. tuberosa* vary in size and shape; they are pyriform or spindle-shaped, ranging in size from a small pear to a large turnip; they are developed upon the

roots of the plant, and are composed of the woody layers of the root spread out and separated by a large addition of soft cellular tissue. The external surface of the tuber is brown and scurfy from exfoliation of the tuberous coat. The cut surface is white and spongy, and shows several concentric rings of woody fibres, and numerous well-marked medullary rays. The taste is somewhat acrid, slightly bitter, and very mucilaginous. The colour is not affected by ferric chloride or solution of iodine.

The following description of the plant is given in the *Flora of British India*:—"Stems shrubby, the branches finely grey downy. Stipules minute, deciduous, cordate-ovate; leaflets membranous, roundish, ½ to 1 ft. long, green, glabrescent above, densely clothed with whitish adpressed hairs beneath; flowers in dense, virgate, leafless, often panicled racemes, reaching 6 to 9 inches long; pedicels very densely fascicled; calyx $\frac{1}{6}$ to $\frac{1}{4}$ in. long, densely silky; corolla short, blue, not quite twice the calyx; limb of standard orbicular, distinctly spurred; pod 2 to 3 inches long, membranous, flat, 3 to 6-seeded, clothed with long grey silky bristly hairs."

Chemical composition.—The peeled tubers in slices, dried by exposure to hot air, and reduced to powder, lost 5·21 per cent. of moisture at 100° C. The ash amounted to 18·01 per cent. No trace of manganese could be detected in the ash.

By exhaustion with 98 per cent. alcohol, a slightly yellowish tincture was obtained, which dried to a brittle mass easily reducible to a whitish powder, possessing a bitter-sweet taste, and partly soluble in boiling water with acid reaction. The resulting aqueous solution was neutralized, and agitated with chloroform-ether, but no evidence of an alkaloidal principle was yielded. The aqueous solution was then acidified and agitated with ether, when a trace of a resin was dissolved. The still acid aqueous solution, after driving off the dissolved ether, was agitated with amylic alcohol. A deep yellowish-brown extract was obtained, easily soluble in alcohol, and which darkened during evaporation. In cold water this extract was only slightly soluble, with a somewhat bitter taste. It was

soluble in alkalies, and yielded a whitish-yellow precipitate on the addition of acids.

The original aqueous solution was again rendered alkaline and re-agitated with amylic alcohol. A small amount of a slightly bitter yellowish extract was yielded, which failed to afford any alkaloidal reactions, but reduced an alkaline copper solution after previous boiling with a dilute acid.

In another experiment the powdered tubers were percolated with amylic alcohol, and the percolate agitated with cold water; a colourless aqueous solution was obtained, which darkened during evaporation, leaving a yellowish residue. On the addition of cold water to this extract a portion dissolved, while the remainder swelled up into a soft mass similar in appearance to recently precipitated partly dried aluminum hydrate. On heating with water this dissolved, and on concentration, white warty masses separated, which under the microscope were seen to be destitute of crystalline structure. This principle is probably allied to inulin, but as far as we are aware no observation has hitherto been recorded on the solubility of inulin in amylic alcohol.

The fresh tubers afforded no reaction for starch. Saccharine matter was present which reduced Fehling's solution. A bitter principle, an easily oxidizable resin, and a resin acid were also present in addition to the principle which we have mentioned as being probably allied to inulin.

URARIA LAGOPOIDES, *DC.*

Fig.—*Burm. Fl. Ind.* 68, t. 53, f. 2.

Hab.—Nipal and Bengal to Ava.

Vernacular.—Pithvan (*Hind.*), Chákulia (*Beng.*), Davala (*Mar.*).

History, Uses, &c.—This plant is of interest as forming one of the ingredients of the Dasamula already mentioned (see *Tribulus terrestris*). On this account it is much used in Hindu medicine, but seldom alone. It is supposed to have

alterative, tonic, and anti-catarrhal properties. The Sanskrit name, Prisniparni, signifies "spotted leaf." In Vedic times the plant was invoked as a goddess. According to Susruta it was given to women in the seventh month of their pregnancy with milk to prevent abortion. The Atharva-veda informs us that Prisniparni kills the monster Kanva, who wants to eat the germ. Another Sanskrit name is Atiguha, which signifies "great mystery."

Description.—Stems densely cœspitose, woody, slender, pubescent; petiole ½ to 1 inch; leaflets many, of both kinds, obtuse, broadly rounded at the base, 1 to 2 inches long, glabrous above, finely downy below; heads always simple, very dense, 1 to 2, rarely 3 inches long, under 1 inch thick, bracts subpersistent, distinctly ciliated; pedicels densely crinite, not longer than calyx; calyx 1-6th to 1-5th of an inch, lower teeth setaceous, densely plumose, corolla scarcely exserted; joints 1 to 2, brown, polished, finely pubescent. (*Flora of British India*.)

The medicinal properties attributed to this plant appear to be entirely fanciful.

Uraria picta, *Desv., Jacq. Ic.*, t. 567. *Vern.*—Dábra (*Hind.*), Sankar-jata (*Beng.*), Prisniparni (*Mar.*), Pilavan (*Guz.*) is supposed by the Hindus to be an antidote to the poison of the Phúrsa snake (*Echis carinata*); it grows along the shady banks of water-courses, and blossoms towards the end of the rains. The stem is erect, shrubby and branched, 3 to 4 feet; leaves alternate, petioled, from simple to pinnate; leaflets, the lower or single, are generally oblong-ovate, two to three inches long, and one and a half broad, the leaflets of the compound leaves are linear lanceolate, all are obtuse, entire, and beautifully clouded on the upper surface, below a little reticulated and downy; racemes terminal, erect, rigid, cylindric, hairy, bracts of the peduncles chaffy, permanent; those of the flowers lanceolate, two flowered, falling; flowers numerous, small, red; pedicels incurved after the flowering time; calyx, apices of the divisions incurved and bearded, legume white and

shining, consisting of from three to six oval joints connected by a slender isthmus, the incurved form of the pedicels presses them so much against the rachis that the form is with difficulty observed; seed kidney-shaped, 1-12th of an inch long, dull yellow. The medicinal properties attributed to this plant also appear to be entirely fanciful.

DESMODIUM GANGETICUM, *DC.*

Fig.—*Wight Ic.*, *t.* 271.

Hab.—The Himalayas to Pegu and Ceylon.

Vernacular.—Sárivan (*Hind.*), Sálvan (*Guz.*), Daye, Salparni (*Mar.*).

History, Uses, &c.—This plant is of interest as being an ingredient of the Dasamula Kvatha so often mentioned in Sanskrit works; it is considered to be febrifuge and anti-catarrhal. In the Dasamula it is placed among the five minor plants (see *Tribulus terrestris*), a decoction of these is directed to be used in catarrhal fever, cough and other diseases supposed to be caused by deranged phlegm. The five major plants are prescribed in fever and other diseases supposed to be caused by deranged air. The ten together are used in remittent fever, puerperal fever, inflammatory affections within the chest, affections of the brain, and many other diseases supposed to be caused by derangement of all the humours. (For further information upon these points, consult Chakradatta.) The Sanskrit name is Shálaparni, "having leaves like the Shál" (*Shorea robusta*). In the Nighantás the root is described as alterative and tonic, and a remedy for vomiting, fever, asthma and dysentery.

Description.—Stems sub-erect, reaching 3 to 4 feet high, woody, slightly angular, clothed with short grey down upwards, leaflet oblong, usually 3 to 6 inches long, not more than $\frac{1}{2}$ to $\frac{1}{3}$ inch broad, rounded at the base, narrowed gradually to an acute point, thinly clothed beneath with adpressed gray hairs, not

reticulate-venose; petiole $\frac{1}{2}$ to 1 inch; racemes copious, ascending, lateral and terminal, the latter sublax, 6 to 12 inch long, simple or with a few short ascending branches in the lower part; pedicels $\frac{1}{12}$ to $\frac{1}{4}$ inch, ascending; bracts minute, setaceous; calyx under $\frac{1}{12}$ inch, finely downy; teeth lanceolate; corolla $\frac{1}{8}$ to $\frac{1}{6}$ inch; pod falcate, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, $\frac{1}{12}$ to $\frac{1}{8}$ inch broad, 6 to 8 jointed, glabrescent, or clothed with minute hooked hairs. (*Flora of British India.*)

The roots have a soft thick bark and a central woody column; no tannin is present.

Chemical composition.—The roots reduced to fine powder yielded:—

Water at 100°C	10·43	per cent.
Ash	6·20	,, ,,
Petroleum ether extract	·62	,, ,,
Ether extract	·47	,, ,,
Alcoholic ,,	1·07	,, ,,
Aqueous ,,	8·76	,, ,,

The ash contained a trace of manganese. The petroleum ether extract was yellowish green, oily, and deposited fine needles on standing: it was partly soluble in alcohol with acid reaction: the insoluble residue was white; no alkaloidal principle was detected.

The ether extract was yellowish, had an aromatic odour, and contained a trace of oil and resin: it was only partly soluble in caustic alkalies, with a deep yellow coloration: no alkaloidal principle was present.

The alcoholic extract contained a principle which gave a marked reaction with alkaloidal re-agents: and a yellow resin soluble in alkalies and reprecipitated by acids. No reaction with ferric chloride. The aqueous extract reduced Fehling's solution; on boiling it gave no precipitate with dilute acids, with ferrocyanide of potassium and acetic acid a very faint turbidity was produced: mixed with an equal volume of absolute alcohol a very slight turbidity was occasioned: plumbic acetate and hydro-acetate both gave a white precipitate.

Ormocarpum sennoides, *DC., Wight Ic. t.* 297, is a low shrub of the Western Peninsula and Ceylon, with terete slender branches. The young shoots and flowering parts are covered with a soft glutinous hair; the glutinous secretion is of a golden yellow colour. The leaves are pinnate, leaflets 9 to 17, alternate, oblong-obtuse, membranous. The racemes are short and axillary, 3 to 6 flowered, flowers yellow. Pods 2 to 5-jointed, pendulous, much contracted at the joints, muricated, glutinous. The plant is called Kát-morungi in Tamil, Kadunugge in Canarese, and Adavimúnaga in Telugu; a decoction of the root is used in fever as a tonic and stimulant, and a liniment (*taila*) in paralysis and lumbago.

Desmodium triflorum, *DC., Vern.* Sirupullady (*Tam.*), Moonoodoo-moordoo (*Tel.*), Kadalaya (*Hind.*), Koolaliya (*Beng.*), Rán-methi (*Mar.*), is very common in sandy ground under the shade of trees. The leaves are used as a galactagogue by native females after confinement; they are well washed and ground with cow's milk, and taken daily in the morning. They are also administered to children as a remedy for diarrhœa caused by indigestion, and in convulsions. (*P. S. Mootooswamy.*) Roxburgh remarks that the natives apply the fresh plant, well bruised, to wounds that do not readily heal.

ABRUS PRECATORIUS, *Linn.*

Fig.—*Rheede, Hort. Mal. viii.* t. 39; *Bentl. and Trim.*, t. 77. Jamaica Wild Liquorice, Jequirity (*Eng.*), Arbre a chapelets (*Fr.*).

Hab.—India and other hot countries. The seeds, root and leaves.

Vernacular.—Gunj, Ghungachi (*Hind., Beng.*), Gunjha (*Mar.*), Gundumani (*Tam.*), Chanoti (*Guz.*), Guri-ginja (*Tel.*), Gulganji (*Can.*).

History, Uses, &c.—This plant is mentioned by Susruta and the older Sanskrit writers, it must therefore have long been in use as a medicine among the Hindus; they describe two

varieties, namely, red and white-seeded. The seeds are said to be poisonous, and are used internally in affections of the nervous system, and externally in skin diseases, ulcers, and as an application to fistulas to excite inflammatory action. The root is described as emetic. Examples of compound medicines containing the seeds, extracted from Sárangadhara, Chakradatta, and the Bhavaprakasa will be found in Dutt's Hindu Materia Medica, p. 152. Mahometan writers under the name of Ain-ed-dik (cock's eye) describe the seeds, and state that they are hot and dry, tonic and aphrodisiac. Their use by goldsmiths as a weight is alluded to in the following well known Doha (couplet):—

> Soná kahe sunár se, "uttum mhári ját
> Kále munh ki ghungchi, aur tule hamáre sáth."

My rank is of the highest, said the gold to the goldsmith, shall I be weighed against that black-faced seed! Sloane, in 1700, appears to have been the first to suggest the use of Abrus root as a substitute for liquorice. Prosper Alpinus, who visited Egypt in 1592, only mentions the use of the seeds as beads, and states that they are sometimes eaten, but are very unwholesome; he calls the plant "abrus," a name probably of Coptic origin, but possibly derived from the Greek αβρος, pretty. Greek and Latin writers do not mention any plant bearing this name. Dr. Burton Brown (*Punjab Poisons*) records a case in which 40 seeds of Abrus, administered internally, caused purging and vomiting, with symptoms of collapse and suppression of urine; the patient recovered under the use of stimulants.

In the Concan singers chew the leaves of the white-seeded variety as a remedy for hoarseness; they are also chewed with cubebs and sugar to cure aphthæ of the mouth. In spermatorrhœa with bloody discharges, equal parts of the juice of white Abrus leaves and Henna leaves are rubbed with the root of *Holostemma Rheedii*, cummin, and sugar, and administered. Abrus seeds are said to have been used for centuries in Brazil as a popular remedy for granular lids and pannus, and attention was called to this practice in Europe in 1862, without apparently leading to any experiments with the drug. Ainslie says:—

"This root, when dried, coincides so exactly with the liquorice root of the shops, that it is often sold for it in the bazaars in Bengal." Other writers repeat the same statement, one which we cannot confirm, as we consider the root to bear very little resemblance to liquorice either as regards appearance or qualities; as pointed out by Mr. Moidín Sheriff, the leaves are by far the sweetest part of the plant, and from them a tolerable extract may be made, but in most parts of India, where true liquorice is obtainable in any quantity as an article of commerce, it would be much more expensive to collect them than to use liquorice.

Description.— Leaves 2 to 3 inches long, abruptly pinnated, leaflets 8 to 20 pair, linear oval, obtuse at both ends, glabrous or slightly hairy, membranous, deciduous, $\frac{3}{8}$ to $\frac{5}{8}$ of an inch long, and $\frac{1}{6}$ to $\frac{1}{5}$ of an inch broad, taste sweet and like that of liquorice. Seeds bright scarlet, with a black spot at one end; white, polished, smaller than a pea; average weight, scarlet variety 1·75, black 1·77, and white 1·97 grains. Root long, woody, hard, and much branched, seldom more than $\frac{1}{4}$ inch in diameter. Cortical layer very thin, reddish-brown; wood yellowish white; odour and taste acrid, hardly at all sweet.

Microscopic structure.—Within the middle zone of the bark is a layer of sclerenchymatous tissue. Liber fibres are scattered through the interior of the cortical tissue, but do not form wedge-shaped rays as in liquorice.

The seeds have been examined by Dr. D. D. Cunningham of Calcutta. (*Ind. Med. Gaz.*, 1882.) Proceeding from without inwards he found—*1st*, a single layer of thick-walled, columnar cells containing colouring matter, each cell dilated peripherally, and in many cases having a slight basal bulbosity. The peripheral dilated portion was observed to be cut up into a number of more or less cuneate portions; *2nd*, a thick stratum of small cells, with thick walls and irregular sinuous outlines; *3rd*, a thick stratum of large thin-walled cells; *4th*, a thin stratum of small also thin-walled cells; *5th*, a stratum of elongated thin-walled cells; *6th*, a stratum of thickened cells, two or

three layers deep; *7th*, a single row of minute thin-walled cells of more or less cubical contour; *8th*, a stratum of thick walled cells with dense yellowish, granular contents; *9th*, a stratum of thickened, more or less parenchymatons cells, with mere traces of cavities or contents. The cotyledons are composed of large thick-walled cells containing granular matter and oil globules. The central cavities of the cells communicate by a system of processes which pass through the cell wall and are met by similar processes from the neighbouring cells.

*Chemical composition and Physiological action.**—The seeds of jequirity contain a substance which, as is well known, when extracted, as in a watery infusion, produces a local irritation and inflammation of the conjunctiva, which has been utilized in practical medicine for the cure of granular lids and of pannus. Its employment in these conditions has not, however, been found to be so beneficial as at one time was thought probable, so that at the present time jequirity may be said to possess chiefly a scientific interest—one, as I shall indicate, of possibly great significance. Investigations into the exact nature of the poison have not been wanting, and the knowledge obtained from them has gone through many curious phases.

From the researches of Sattler, Cornil, and Berlioz, it was concluded that the irritant action of jequirity was due to a special bacillus which grew in the infusion of the seeds, and was called the jequirity bacillus. Contrary, however, to the behaviour of liquids containing specific bacteria, the physiological activity of the infusion of abrus seed was totally destroyed by heating it to the boiling point of water (Klein); and, following this result, Warden and Waddell† separated from the seed a body they called "abrin," which was a proteid body, and which possessed the physiological properties of jequirity. Furthermore, although these observers found bacteria in the local lesions produced by jequirity, these organisms were of various kinds,

* From a report by Dr. Sidney Martin, presented to the Scientific Grants Committee of the British Medical Association, *Brit. Med. Journal*, July 27.

† "The Non-Bacillar Nature of Abrus Poison," Calcutta, 1884.

and, after cultivation and separation, were found to have none of the poisonous properties of jequirity. To dispose at once of this idea of the bacterial nature of jequirity poison, I may say that in my experiments, using a pure product, I have found no bacteria present in the local lesions, either in those produced at the seat of injection or in those produced internally in the peritoneum or alimentary canal. The sections were stained by Gram's method.

We must look, therefore, to the proteid or proteids present in the seed for the poison of jequirity. Warden and Waddell's "abrin" as described by them, did not possess very definite characteristics; it was called a vegetable "albumin," but evidently did not belong to this class, as it was precipitated by acetic acid. In 1886, I separated and examined the proteids present in the seeds, and obtained the following results*—both of the proteids separated possessing poisonous properties.

Nature of Jequirity Poison.—The seeds contain two proteids—a globulin and an albumose. The globulin is soluble in 15 per cent. sodium chloride solution, and coagulates by heat between 75° and 80° C. Like other members of its class, it is precipitated from solution by saturation with sodium chloride and magnesium sulphate. It belongs to what I have described elsewhere as the vegetable paraglobulins.† The albumose is soluble in water, is not precipitated by boiling, but is thrown down by nitric acid, the precipitate being soluble on heating the solution and coming down again on subsequent cooling, this being the characteristic reaction of the albumose class. This body also gives the "peptone" reaction, namely, a pink coloration with copper sulphate and caustic potash.

For the investigation of the physiological action of these two proteids, the mode of separation from the seed is important, because, as I shall discuss subsequently, it is a question whether these proteids are of themselves poisonous, or produce their toxic effects by having a non-proteid body, as it were,

* *Proc. Roy. Soc.*, vol. 42, p. 331.

† *Proc. Physiolog. Soc.*, 1887.

tacked on to them—in fact a body, possibly alkaloidal in nature, not completely separated from the proteid in the preparation of the pure poison.

The globulin is separated by extracting the crushed and decorticated seed with 15 per cent. sodium chloride solution, and precipitating the clear filtrate by saturation with solid sodium chloride after acidulating with acetic acid. The precipitate of globulin with part of the albumose is mixed with distilled water, and dialysed in running water for several days. The globulin is in great part thrown down in the dialyser, while the albumose remains in solution. The globulin is now removed by filtration, and washed with distilled water (previously boiled to sterilise it) for two days, in order to remove any albumose or sodium chloride clinging to the precipitate, the absence of the albumose being tested by the washings giving no reactions for a soluble proteid, and the absence of the salt by a negative reaction with silver nitrate. The globulin is then removed from the filter and dried over sulphuric acid. Prepared in this way, it is a whitish-yellow, amorphous powder, soluble for the most part in 15 per cent. sodium chloride, and giving the reactions previously described. In the dried state, it may be kept for a long time without losing its physiological properties. Specimens prepared for more than fifteen months are as active now as when first dried. This fact is, indeed, only in accordance with the behaviour of other dried proteids; they can be kept an indefinite time in the dried state without undergoing any chemical change.

The albumose was prepared by making a concentrated watery extract of the seeds, and filtering the clear infusion direct into an excess of absolute alcohol, thus throwing down both proteids as a white precipitate. After a few days the precipitate was removed, redissolved in water, and reprecipitated by alcohol, this process being repeated at intervals of a few months. The precipitate was allowed to stand under alcohol for about eight months or longer, at the end of which time the globulin was completely coagulated, while the albumose was still soluble in water. Dried over sulphuric acid,

the residue was a yellowish-brown, amorphous powder, consisting of coagulated globulin and unaltered albumose.

*Physiological Action of the Proteids of Jequirity.**—For subcutaneous injection and for instilling into the eye a solution of the proteids was made. The globulin was dissolved in 15 per cent. sodium chloride solution, and the albumose in distilled water or normal saline solution (0·75 per cent. NaCl). Previous to using these liquids or solvents, they were well boiled to sterilise them, and then cooled. A weighed quantity of the proteid was then dissolved and used in the experiment; or a solution of the proteid was made, and the quantity present was estimated.

Local Action on the Eye.—A watery infusion of the seeds when instilled into the eye produces, as is well known, severe inflammation with purulent discharge; and it is this action which is both beneficial in the treatment of granular lids and of pannus. Both the globulin and the albumose of jequirity possess this property. Thus in one experiment 2 milligrams of the solid globulin (containing some coagulated proteid) were placed on the inner surface of the left eyelid of a large rabbit. In seventeen hours and three-quarters the conjunctiva was reddened and slightly swollen; there was no chemosis, but there was a clear serous discharge. In twenty-four hours, there was intense purulent ophthalmia, with subconjunctival ecchymosis: the cornea being quite clear. The purulent discharge lasted till the death of the animal, eighty-three hours after inoculation; the animal being apparently ill for about four hours before death. At the *post-mortem*, there was severe subconjunctival hæmorrhage, with œdema round the eyeball. If the dose be smaller, the animal does not die after eye inoculation, nor does it suffer from any general symptom; but local inflammation and œdema with purulent discharge always follow in about sixteen or seventeen hours.

* The action of the globulin was investigated in co-operation with Dr. Wolfenden; for the account of the albumose I alone am responsible. The results are published in two papers in *Proc. Roy. Soc.*, May 1889.

One milligram of the albumose dissolved in two minims of sterilised distilled water, when placed on the eye of a rabbit produced in less than twenty-four hours severe conjunctivitis with chemosis, and left at the end of six days a steamy cornea with leucomata and subconjunctival ecchymosis. The animal showed no symptoms of poisoning. Both globulin and albumose therefore possess this property of producing severe conjunctivitis.

General Action on the Body.—The symptoms produced by the subcutaneous injections of the proteids of jequirity are those which have been described by Drs. Warden and Waddell. The action of the globulin is not, however, quite identical with that of the albumose. In the first place, the globulin is more poisonous than the albumose. In rats, for example, 10 milligrams of globulin per kilo of body-weight is a fatal dose, and in the same animals, 60 milligrams of albumose per kilo of body-weight.

If the above mentioned dose of globulin be injected into a rat, symptoms of poisoning begin to appear in about six hours; the animal them seems a little languid, and in a condition impossible to distinguish from sleepiness. It continues in this state, making no voluntary movement, irresponsive to slight external stimuli, and with half shut eyes. It lies huddled up in its cage, the breathing becomes more rapid, and bloody motions are passed shortly before death, which occurs in about twenty-four hours after inoculation. If the animal is with young, it aborts. *Post-mortem,* there are signs of œdema and punctiform ecchymosis at the seat of injection, and punctiform ecchymosis also beneath the peritoneum, and sometimes in the lungs. The intestines are congested, and sometimes greatly inflamed; the adenoid patches in the mucous membrane are swollen, and submucous ecchymoses are often seen. The blood sometimes remains fluid for a long time, and is sometimes coagulated. The symptoms of poisoning by the albumose and the *post-mortem* signs are similar to those described as produced by the globulin.

It may be pointed out that there are no symptoms referable to definite lesions of the organs, except the occurrence of bloody motions due to gastro-enteritis. The sleepiness, in gradually increasing coma, may be explained by an effect on the cerebrum; as there is not sufficient dilatation of the vessels of the abdominal organs to explain the occurrence of coma by drainage into the "splanchnic area," the occurrence of rapid breathing, which is produced chiefly by the globulin, may be explained by an affection of the respiratory centre. The only early symptom of abrus poisoning is a fall of body temperature, and this is produced both by the globulin and the albumose.

This lowering effect of the jequirity proteids on body temperature was noticed in cats by Warden and Waddell. It is important, when taken in consideration with the fact that rattlesnake venom produces a similar effect (Weir-Mitchell and Reichert), and that, on the other hand, animal albumoses and peptones have been shown by Ott and Colmar* to produce fever in mammals.

Effect of Heat on the Activity of Jequirity Proteids.—Boiling the liquid destroys the activity of the infusion of jequirity seeds. This, as has been mentioned, is an argument against the bacterial nature of the poison. It was desirable to test, however, with exactness at what temperature this activity was permanently destroyed. For this purpose solutions of the globulin and albumose were momentarily heated up to 50°, 60°, 75°, 80°, 85°, C. before being used for inoculation. In each separate series of experiments an unheated solution of proteid was also inoculated, in order to have a control, and a lethal dose was always used. For the details of these experiments the papers in the *Proceedings of the Royal Society*, already quoted, must be referred to. Suffice it to say here that the results obtained were—(1) that the activity of the globulin was permanently destroyed by momentarily heating its solution to between 75° and 80° C., that is, about its coagulation temperature, while the solution of albumose had to be heated up to 85° C., before

Journal of Physiology, vol. viii., p. 218.

the activity of the proteid was destroyed; (2) that momentary heating of the solution to above 50° C, but below 75° in the case of the globulin, and 85° in the case of the albumose, weakened the activity of the proteid without destroying it.

The conclusions therefore arrived at regarding the jequirity poison may be thus summarised:—

1. The toxic action of the jequirity (*Abrus precatorius*) resides in two proteids—a globulin and an albumose.

2. Both these proteids produce nearly the same effects, namely, local œdema and ecchymosis at the seat of inoculation, with ecchymosis in the serous membranes, and gastro-enteritis, the blood in many cases remaining fluid. The general symptoms are a gradual sleepiness, ending in coma, with rapid onset of rigor mortis.

3. That both portions have a remarkable lowering effect on the body temperature; the globulin, at the same time, producing rapidity of breathing, while the albumose does not have this effect to the same degree.

4. That the activity of both proteids is destroyed by a temperature below the boiling point of water; the globulin between 75° and 80° C. and the albumose at 85° C., while temperatures below these points but above 50° C. diminish the poisonous activity.

Relation of the Abrus Poison to Snake Venom.—It is chiefly due to the researches of Weir-Mitchell that the poisonous principles of snake venom have been shown to be of an albuminoid nature. In the latest publication on the subject Weir-Mitchell and Reichert* affirm as the result of their analyses and experiments that the poisonous proteids present are of two kinds—a globulin and a peptone, or peptone-like body; that all kinds of venom contain these two bodies, although in varying proportions, speaking generally, the globulin being greater in proportion to the "peptone" in viperine snakes (such as the rattlesnake), and the peptone being in greater proportion in the

*"Researches upon the Venom of Poisonous Serpents," Philadelphia, 1885.

colubrine snakes, such as the cobra; that both the globulin and peptone of the venom are poisonous, producing practically the same general symptoms, but with this exception (and a noticeable one it is), that the great local ecchymosis and inflammation of snake-bite is due to the globulin present in the venom and not to the "peptone."

For reasons which I have detailed elsewhere,* it seems to me that Weir-Mitchell and Reichert's venom "peptone" is not a true peptone, but belongs to the albumose class of proteid bodies. The relation of abrus poison to snake venom is now apparent. Abrus seed contains two poisonous proteids—a globulin and an albumose—which both produce local œdema and ecchymosis. Rattlesnake venom also contains a globulin and a peptone-like body (probably an albumose), the former of which produces local ecchymosis and inflammation. The resemblance is further strengthened by the fact that heat diminishes the activity of both abrus poison and of snake venom; but in this respect abrus poison seems to be more sensitive than venom. Thus, even after boiling and filtering, rattlesnake venom, if given in sufficient dose, is fatal; and cobra venom is still active (although permanently destroyed by boiling for half an hour) while, with abrus proteids, a momentary heating of the globulin in a solution up to 80° C., is sufficient to destroy its activity, while with the albumose the destroying temperature is 85° C. Rattlesnake venom, like abrus poison, also lessens the body temperature. The great difference, however, between snake venom and abrus poison rests in the fact that venom produces local paralysis and general convulsions, while abrus has no such effect. Abrus seems to affect the cerebral hemispheres, producing stupor, ending in coma.

It is evident, therefore, that while abrus poison bears some resemblance to snake venom it is far from being identical with it.

Nature of Abrus Poison.—At present it is not explicable why proteids should be poisonous; why, when injected sub-

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* *Proc. Roy. Soc.*, May, 1889.

cutaneously or into the venous system, they should cause death. And so anomalous does the toxic power of these bodies seem that we are bound to consider whether a proteid is of itself poisonous or possesses toxic properties by virtue of some agent or body tacked on to it or formed from it. Such an agent associated with a proteid would be called a "ferment." We know that the ferments used in digestion are normally associated with proteids, although Cohnheim claimed that he had separated ptyalin from all associated proteid, and Brücke stated the same of pepsin; and even granting that these two ferments may be separated from their associated proteids the fact remains that ferments are in nature closely linked with albuminoid bodies. What characteristic of unorganized ferments, we may fairly ask, are present in abrus poisons which would lead to the supposition that what might be called a "toxic" ferment is present? The unorganized ferments known alter the constitution of the bodies on which they act, the digestive ferments acting on proteids, amyloids, and fats, while other ferments, such as the fibrine ferment and the curdling ferments, cause the proteids on which they act to assume a solid form. All these ferments have certain characteristics common to all; their action is increased by a moderate heat and permanently destroyed by boiling their solutions; and their activity is not apparently diminished after they have produced their effect.

From this it will be seen that the fact which would point to abrus poison being a "toxic" ferment is the fact that its activity is permanently destroyed by a moist heat below 100° C. Farther than this we cannot at present go. Abrus globulin and albumose possess neither a proteolytic nor amylolytic action, whatever the reaction of the digestive mixture may be. The fact that the activity of the globulin is destroyed at about its coagulation temperature would seem to point to an alteration in the constitution of proteid as the cause of the loss of poisonous activity; but this again is the temperature at which ferments are destroyed. No evident effect, chemical or physical, is noticed if the albumose be heated up to 85° C. or even boiled, yet its toxic activity is at once and for ever destroyed. This may point to a ferment

associated with the albumose; but until we know the chemical constitution of the proteid molecule we cannot assert that this degree of heat does not so alter the construction as to prevent the development of the toxic action. In this uncertain condition the matter must at present rest. It may be considered that the toxic action is not due to the proteid nor to a ferment attached to it, but to some chemical toxic body carried down with the proteid in its preparation. The effect of heat on the toxic activity of abrus would seem at once to dispose of this view. Toxic bodies, such as ptomaines and leucomaines, formed from proteids, are not so sensitive to heat as the abrus poison; and if the details of the preparation of abrus globulin and albumose be referred to it will be seen that the prolonged dialysis in running water and the long extraction of the albumose by alcohol preclude the presence of any crystalline product in the residue obtained.

The concentrated aqueous infusion of abrus root has a dark brown colour, and a somewhat acrid taste accompanied by faint sweetness. When it is mixed with an alkaline solution of tartrate of copper, red cuprous oxide is deposited after a short time; hence we may infer that the root contains sugar. One drop of hydrochloric or other mineral acid mixed with the infusion produces a very abundant flocculent precipitate, which is soluble in alcohol. If the infusion is mixed with a very little acetic acid, an abundant precipitate is obtained, but is dissolved by an excess. This behaviour is similar to that of glycyrrhizin. The leaves contain a sweet principle similar to that of liquorice. (*Pharmacographia.*) Warden and Waddell have pointed out that the stems and roots of the Abrus plant possess toxic properties similar to the seeds. This fact is of importance when it is remembered that the roots are referred to in the *Pharmacopœia of India* as a substitute for liquorice.

Dr. Warden has succeeded in isolating an acid from the seeds, which he represents by the formula $C^{21} H^{24} N^{3} O^{4}$, and has named *abric acid.* He also obtained a small quantity of pungent volatile oil, but both these substances proved to be inert.

Toxicology.—The Cattle Plague Commission, in their report dated 1870, remarked that a large proportion of the criminal cases of cattle-poisoning are effected through the agency of Abrus seeds. In 1873, Dr. Center drew special attention to this fact; and more extended inquiry showed that this practice was common throughout the greater part of India. The Chamár or "Skinner" caste are the class who mostly practise this mode of poisoning, and although their object usually is to obtain a supply of hides, they have been known to use these seeds for the purpose of committing murder. These people prepare small spikes by soaking the seeds in water and pounding them; these are dried in the sun, oiled and sharpened upon a stone, so that when fixed loosely in a handle they can be driven beneath and left in the skin of an animal. They are called by the natives *sui* (needles) or *sutari* (awls). (*Conf. Ann. Repts. of the Chem. Examiners of Bengal and N.-W. Provinces from* 1874 *up to date.*)

Dr. Warden* says:—"The preparation of 'suis' is an operation which apparently requires some little skill; and the following particulars are from an article in the *Police Gazette* for December 1880, communicated, I believe, by an officer in the Police Department, who obtained his information from a Chamar prisoner in the Patna Jail, who prepared 'spikes' before him, with one of which a bullock was stabbed in the back of the neck, death ensuing on the second day. The shell of each seed is carefully broken and removed, and the seeds softened by soaking in water, and pounded on a stone in order to form a paste. The lump of paste is then rolled with the palm of the hand on the stone, until it is of a cylindrical shape, with a sharp point. The point, about ¾ of an inch long, is then cut off and forms the 'sui,' or 'sutari,' as it is termed in some districts, from its resemblance to the point of a cobbler's awl. After half-a-dozen or more 'sutaris' have been made, some straw is cut into lengths of about 2½ inches, and a 'sutari' inserted in each end; the straws are then put in the sun to dry, care being taken that the 'sutari' points are not injured. As

* Notes on the seeds of the *Abrus precatorius.*—*Ind. Med. Gazett* 188 .

soon as a 'sutari' is thoroughly dry and hard, the point is 'edged' on a brick, after which it is soaked in some animal fat for a night, and the instrument is ready. Occasionally the point of the 'sutari' is slightly curved. Suis weigh on an average 1½ to 2 grains, and vary in colour from dirty white to dark brown or nearly black. A handle of wood is then made, about 3 to 3½ inches long, and like the handle of a bradawl. At the end of the handle, which is about an inch in diameter, two holes are drilled, about ¼ to ⅜ of an inch in depth, and about ¾ of an inch apart, and into each hole the thick end of a 'sutari' is pressed, a piece of cloth being first spread over the holes in order to afford a firmer hold. Bamboo wood is frequently used for a handle, a small cane being selected, and a portion cut off so as to include two joints: one joint has the holes drilled for receipt of the 'spikes,' while the other is sometimes removed, exposing the cavity of the bamboo, in which the spare 'sutaris' are kept wrapped in a rag. The blow given with the instrument is delivered with great force, so that the whole of the sutari protruding from the end of the handle is driven into the flesh; any attempt to withdraw the 'sutari' by pulling at the piece sticking out, invariably breaks it, a portion being left in the wound."

"In some cases *suis* are made with the milky juice of the *Calotropis gigantea* instead of with water, and the effect is then supposed to be more rapid. Metallic mercury, dhatura, aconite and arsenic are also occasionally added. When the subject of *sui* poisoning first engaged attention there was a suspicion that snake venom might possibly be the active agent, but this was shown to be incorrect."

"A few cases have been recorded in which 'sui' wounds have proved fatal in the human subject. In the Bengal Police Report for December 1880, the following note occurs: 'In 1871 a man was murdered by a sutari being driven into his side; lately another man was wounded by a sutari while asleep, and died from lock-jaw; a third man was wounded with a sutari, but escaped death by the affected part being excised. This man's cousin, however, died from the effects of a sutari

being driven into his cheek. The offenders in these cases were suspected to be Chamars, who being poor and of low caste, can be induced to undertake such acts of assassination for small remuneration.' "

"Mr. W. Sutherland, Barrister-at-law, of Bankipore, has kindly furnished me with notes of one of the above cases, in which a man was killed by being stabbed in the cheek with a 'sutari': these notes throw an interesting light on the value in which human life is held in India, in districts in which civilization is supposed to be advanced. The case occurred at Bankipur, and two persons were implicated, a man and a woman; and the following is an abstract of the statement of the latter:—'I used to earn my living in Bankipur, at Sunt Aman Khan's. Aman Khan, his chella, turned me out, and would not give me sufficient food. I stole a seer of rice, and he abused and beat me. I was crying and lamenting over my ill-fate. Mugyra said, "Why are you crying?" I said "If some one killed him, it would be well." She said, "Call Suntokhi, and he will put you up to something." I then went to Suntokhi Chamar's, and told him to get some medicine that would kill Aman Khan. He said he would go to Magha and bring some. After ten days he told me he had not been to Magha. Mugyra then told me to go to Dooly Chamar, who was a great poisoner, and had killed several persons. Dooly, on being spoken to, asked for 50 or 100 rupees. I therefore remained quiet. After ten days, Dooly came to my house and wanted 5 rupees and seven pieces of cloth of seven colours, and black pigeons and a black kid; I gave him one rupee and a half, the price of the things. The next morning he came to me for five rupees advance, saying he would destroy my children, if I did not pay it, by means of witchcraft. I paid him five rupees: after this he again threatened me, and I gave him ten rupees. When 8 or 10 days had passed he said he would do what I wanted, and on the night fixed, he smoked in my house, aud then at midnight stabbed the wrong man.' Both prisoners were sentenced to transportation for life under sections 304 and $\frac{304}{109}$ of the Penal Code."

"The wound inflicted in this case is described as penetrating about ¾ of an inch deep, and implicating the skin and muscles of the right cheek. After the injury, the wound appears to have been incised, and 'two small black hard substances' extracted. The patient was treated in the Government Dispensary, Bankipur, and died apparently, on the third day after the accident, from tetanus. In the autopsy report a cursory reference only is made to the wound; it is described as 'one penetrating wound, with some swelling on the right cheek.' The brain and its membranes, and the lungs, liver, spleen, and kidneys were congested. The coats of the stomach were congested, and some ecchymosed spots were visible on its internal surface. The intestines were healthy."

"Judging from the medical evidence, death appears to have been clearly due to traumatic tetanus; and there is no record of symptoms, such as have been observed after the insertion of a 'sui' into the tissues of one of the lower animals. No evidence was apparently adduced to prove that the 'two pieces of small black hard substances' extracted from the wound, were really fragments of a 'sutari' or poisonous. The part therefore played by the *poison* of the 'sutari' is very problematical: and a fatal result would probably have ensued had the man been stabbed with a *thorn*, instead of with a *sui*.

"Dr. Center* has recorded notes of a fatal case of sui poisoning, in which the cause of death appears to have been clearly traceable to the poisonous nature of the 'sutari.' A man when sleeping was awakened in the morning by two blows on the neck, and appears to have seen his assailant retreating. After he went out to his work, his mother found two substances, each a little larger than a barley-corn, on his bed. On his return at mid-day, he complained of pain in the neck, and his mother found two punctures, and out of one of these she picked a small black substance similar to those found on the bed. He was taken to Rawalpindi on a charpoy, arriving on the following morning, when he was immediately examined by Dr. Ince, who reports—'I found a swelling on the right side

* Report, Chemical Examiner, Punjab, 1873.

of the neck, in which were two small punctures, about two inches apart. He was then sensible, but suffering from severe pain in the neck; difficulty of swallowing and much fever. He was sent for treatment to the dispensary. The swelling and pain in the neck rapidly increased and erysipelas supervened. He died exactly three days after having been stabbed. On *post-mortem* examination there was much swelling of the neck, extending over the right side of the chest also, and the skin had a livid appearance. On cutting into the swelling, much blood was found, and the products of inflammation. This had extended to the right lung, which was also much inflamed, and adherent to the ribs by recent bands of lymph. The other organs were healthy, except the spleen, which was somewhat enlarged. The *three small black substances* mentioned were examined by Dr. Center, and recognized as part of such suis as are often sent in cases of cattle poisoning. Microscopically their characters were found to agree with those of rati seeds. Blood was found on one. On insertion below the skin of a dog, the animal died in 50 hours, and on *post-mortem* examination, diffuse inflammation, extending from the puncture along part of one side of the body was found."

The roots of **Taverniera nummularia**, *DC.*, and **Alysicarpus longifolius**, *W. & A.*, are sweet like liquorice, and are called *liquorice* by the Indian peasants.

MUCUNA PRURIENS, *DC.*

Fig.—*Wight Ic., t.* 280; *Bentl. and Trim., t.* 78. Cowhage (*Eng.*), Petit pois pouilleux (*Fr.*).

Hab.—From the Himalayas in the plains, to Ceylon and Burma.

Vernacular.—Kiwachh (*Hind.*), Kuhilí (*Mar.*), Punaik-kali (*Tam.*), Alkusi, Kámách (*Beng.*), Pilli-adugu, Dulagondi (*Tel.*), Nasaguni-gida, Turachi-gida (*Can.*), Kivánch (*Guz.*).

History, Uses, &c.—The plant has long been used medicinally by the Hindus; according to Susruta the seeds are

aphrodisiac. The Bhavaprakasa gives the following directions for their administration:—"Take of Mucuna seeds 32 tolás, boil them in 4 seers of cow's milk till the latter becomes thick. The seeds should now be decorticated and pounded, fried in ghi (clarified butter), and made into a confection with double their weight of sugar. The mass should then be divided into balls and steeped in honey. Dose about a tolá (180 grs.)." This preparation is said to be powerfully aphrodisiac. (*Dutt's Hindu Materia Medica*, p. 148.) Similar properties are ascribed to the seeds (Hab-el-kulai) in Persian works. In the Concan a paushtik for spermatorrhœa is made by powdering the seeds of Gorí Kuhili (cultivated mucuna) and *Tribulus terrestris*, the roots of *Eriodendron anfractuosum* and *Asparagus adscendens*, emblic myrobalans, Tinospora starch, and sugar-candy, in equal proportions; of this powder 6 massa with 2 tolás of ghi are given in cow's milk twice a day. The root is considered a nervine tonic, and is prescribed in paralysis. The Sanskrit names of the plant are Atmagupta, "having hidden properties," Kapikachchhu, "monkey's itch," and Vánari, "monkey plant." According to Ainslie, a strong infusion of the root, sweetened with honey, is given by the Tamil doctors in cholera. The use of the hairs of the Mucuna pod as a vermifuge to expel ascarides appears to have originated in the West Indies, no mention of such an employment of them being found in native Indian works.* They were introduced to the notice of English physicians by Bancroft about 1769, and were probably first used in India upon their admission into the Edinburgh and London *Pharmacopœias* (1783-1809). They are now official in the Indian *Pharmacopœia*, but are hardly ever prescribed in this country. Still there is a considerable demand for the article in the Indian market for exportation to Europe, and it is supposed to be required for the preparation of some patent vermifuge.

* In the Wanaushadi Prakásha, a Marathi work which describes the domestic remedies of the Concan, their use with gúr as an anthelmintic is mentioned, but as this work is of very recent date, the practice may have been introduced.

Description.—The pods are slightly curved like the letter S, 3 to 4 inches long, and contain from 4 to 6 seeds of a dark brown colour and of the shape of a kidney bean. The valves are covered with rigid brown hairs about $\frac{1}{10}$th of an inch long, which give rise to much irritation of the skin if handled.

Microscopic structure.—Most of the hairs consist of a single conical cell barbed near the point, but some of them are divided by partitions. Their action appears to be simply mechanical.

Chemical composition.—The hairs when treated with sulphuric acid and iodine assume a dark brown colour. Boiling solution of potash does not considerably swell or alter them. They are completely decolorised by concentrated nitric acid. (*Pharmacographia*, 2nd *Ed.*, p. 190.)

The decorticated seeds reduced to fine powder and dried at 100 C. lost 10·26 per cent. in weight. The ash amounted to 4·02 per cent. The cortical portion of the seeds contained 7·80 per cent. of moisture and 3·12 of ash. Manganese was only present in minute traces in the decorticated seeds, the cortical portion, on the other hand, contained a very marked amount. The examination of the pounded entire seeds was conducted by Dragendorff's method:—

Petroleum ether extract	3·08 per cent.
Ether extract	·08 „ „
Absolute alcohol extract	2·12 „ „
Aqueous extract	31·92 „ „

The petroleum ether extract was very pale yellow and thick, non-crystalline, and without odour. In 98 per cent. alcohol it was partly soluble, the solution being acid in reaction. The extract consisted chiefly of a free fatty acid and its glyceride, probably oleic acid.

The ether extract was slightly yellow and non-crystalline; it was insoluble in dilute acids. In aqueous ammonia it was partly soluble with yellow coloration; the addition of acids caused the separation of white flocks of acid resin. The alcoholic extract was yellow, and darkened somewhat on exposure.

It did not give any reaction for alkaloids; with ferric chloride it gave a green coloration. The aqueous extract gave marked indication of the presence of albumin; it did not reduce an alkaline copper solution on boiling. The solution was strongly acid in reaction; the nature of the organic acid was not determined.

Mucuna monosperma, *DC., Wight in Hook. Bot. Misc. ii.,* 346, *Suppl., t.* 12; *Wall. Ill. As. Rar. iii.,* 19, *t.* 236; a plant of the Eastern Himalaya, tropical Zone, W. Peninsula, and Ceylon; *Vern.* Songárvi, Mothi-kuhili (*Mar.*), Thelu-kodi (*Tam.*), bears a large, flat, nearly circular seed, with a rough, black testa, 1 inch or more in diameter; the whole of its convex margin is occupied by the hilum. The pods are semi-oval, obliquely plaited, one-seeded, and armed with formidable stinging hairs of a golden brown colour. It is used as an expectorant in cough and asthma, and applied externally as a sedative. (*Peters.*)

CYLISTA SCARIOSA, *Ait.*

Fig.—*Roxb. Cor. Pl. i. t.* 92; *Wight Ic. t.* 1597.

Hab.—Concan, Deccan, Canara and Orissa. The roots.

Vernacular.—Ránghevada (*Mar.*). This plant is the sole representative of the genus Cylista, and is a perennial twiner growing among bushes, with ternate leaves, having oval, pointed and entire leaflets with short white pubescence, very dense on the under-surface. The yellowish-red flowers, about half an inch long, borne on erect bracted recemes, are remarkable for their large papery calyx, which is much more conspicuous than the corollas, and is deeply four-cleft; the upper segment being two-lobed, the lateral ones much smaller, and the lowest very large, all of them beautifully veined. The little oval one-seeded pod is completely enveloped in the peculiar calyx, which affords the most marked character in the genus. (*Fl. Brit. Ind.* ii., 219; *A. A. Black in Treasury of Botany* i. 371.) This plant is called by the natives of the Concan रानघेवडा (*Rán-ghevada*), a word compounded of Rán (*wild*) and

Ghévada, the name of a kind of *Dolichos Lablab* (5th var. of Roxburgh). The root, which is woody and tapering, is collected by the herbalists and sold as a remedy for dysentery and leucorrhœa; it is also applied externally along with other drugs to reduce tumours. Its most remarkable property is astringency; a reddish viscid juice issues from it when cut, which on drying becomes black and brittle, and may be seen adhering to the short pieces of the dry root which are offered for sale.

Description of Root.—A tapering woody root, upper portion 2 inches or more in diameter, dark brown, marked by very numerous circular light coloured scars which do not extend round its entire circumference. The transverse section shows three layers of porous woody tissue of a reddish colour, the central pith and medullary rays being light coloured; in the dry drug the section is obscured by the black exuded juice. Taste astringent and bitterish.

Chemical composition.—Powder light brown, turning pink by exposure. A decoction of the root became purple with ferric chloride and a bulky precipitate separated; it also struck a blue colour with iodine: tannin and starch were thus indicated. More exact determinations showed that the drug yields 23 per cent. of aqueous extract containing 9·9 per cent. of tannin, and 25 per cent. of alcoholic extract with 13·7 per cent. of soluble and insoluble tannins. An insignificant amount of soft yellow tenacious resin was removed by ether. No alkaloidal principle was detected.

ERYTHRINA INDICA, *Lam.*

Fig.—*Wight Ic., t.* 58; *Rheede Hort. Mal. vi., t.* 7. Coral tree (*Eng.*), Arbre de corail (*Fr.*).

Hab.—Throughout India. Leaves and bark.

Vernacular.—Pángra, Párangá, Mándár (*Hind., Mar.*), Pálitá-mándár (*Beng.*), Kaliyana-murukku (*Tam*), Bádidapu-chettu, Bádchipa-chettu (*Tel.*), Páraválada-mara, Harwana, Warjippe (*Can.*).

History, Uses, &c.—The Indian Coral tree, in Sanskrit Páríjáta or Párijátaka and Mándára, is supposed to flower in Indrá's garden. An episode in the Puranás relates the quarrels of Rakhmini and Satyabháma for the possession of the flowers which Krishna had stolen from the garden. The leaf is supposed to represent the Hindu trinity, the middle leaflet is Vishnu, on his right is Brahma, and on his left Shiva. The Portuguese have named them "Folhas da Trinidade." Rheede says that the leaves are discutient, and that their juice is given for syphilis. Rumphius relates that the leaf-juice is applied to ulcers to clean them, and that cooked with cocoanut milk the leaves are used internally and externally as a galactagogue and emmenagogue. The bark is used in dysentery. (*Hort. Amb. iii.*, 33.) Loureiro and Wight state that the bark is used as a febrifuge. Dr. Kani Lal Dé, in a communication to the Calcutta Exhibition Catalogue, says:—"It is anthelmintic and useful as a collyrium in ophthalmia. The leaves are applied externally to disperse venereal buboes and to relieve pain in the joints." In the Concan, the juice of the bark and young leaves is used to kill worms in sores and to disperse tumours; the young roots of the white-flowered variety are pounded and given with cold milk as an aphrodisiac. MM. Corre and Lejanne (*Resumé de la Mat. Med. Coloniale*) state that the bark is expectorant and febrifuge, and the leaves laxative and diuretic. In the Brazils the bark is used as a hypnotic.

The first physiological experiments made with the bark of this tree were those of MM. Bochefontaine and Rey, who communicated the results arrived at by them to the Académie des Sciences in 1881; they concluded that the drug acts upon the central nervous system so as to diminish or abolish its functions.

MM. Pinet and Duprat resumed the study of the action of this drug upon frogs in 1886, and communicated the following results to the Société de Biologie:—One centigram of the watery extract of the bark was introduced under the skin of the right hind leg of a frog, weighing 30 grams. This caused considerable local irritation, but at the end of 25 to 30 minutes the frog remained motionless; placed on its back it remained in that

position, only occasionally making slight spontaneous movements: if a limb were pinched only very feeble reflex movements were induced. When the left sciatic nerve was excited by a Pulvermacher's clamp, the distant end of the divided nerve responded to the stimulus, whilst the near end was hardly affected. The electric contractability of the muscles was diminished, and reflex action abolished. Respiration became very slow and was sometimes suspended. Moreover the heart was observed to dilate very slowly, and the ventricle at the time of systole, which had become imperfect, assumed a folded appearance, and at the diastole the heart presented a marbled appearance, pale in some places and red in others. The strength of the contractions was not much affected.

At the end of 35 to 40 minutes the heart recovered its normal condition. (*Les Nouveaux Remèdes, Sept.* 15*th*, 1886.)

Description.—The fresh bark has a smooth grey suber, and bears small fissured corky lenticels arranged in perpendicular rows. On rubbing off the thin suber a green surface is exposed. The outer portion of the bark is granular and brittle, the inner consists of numerous layers of liber cells interlaced so as to form an open network. The bark has a disagreeable flavour, but is not bitter.

Chemical composition.—A decoction of the bark has no distinct odour or taste, and is not affected in colour by iodine or ferric chloride. Spirit dissolved out two resins, one soluble, the other insoluble in dilute alkali, and a bitter alkaloid. The alkaloid is best prepared by rendering alkaline the aqueous solution of the alcoholic extract and shaking with chloroform, the amorphous slightly coloured base is left on dissipation of the solvent. The alkaloid is very soluble in spirit, benzol and acid solutions, and only slightly soluble in ether and water. It gives coloured precipitates with hydrargyrate of potassium, iodine in potassium iodide and tannin, white precipitates with ammonia and soda. Oxidizing agents as potassium bichromate or manganese oxide with sulphuric acid produce with it a transient purple solution; sulphuric acid alone forms a red, and

nitric acid a yellow colour. The hydrochlorate is crystalline and deliquescent, and the alkaloid is subject to decomposition from prolonged heating or if evaporated with an excess of acid.

Since the discovery of the above alkaloid by one of us, we have learnt that an alkaloid, *Erytherine*, having somewhat similar properties, has been found by Dr. F. Allamirano in the same tree growing in Mexico (*Pharm. Post., June 23rd,* 1889.) Dr. Allamirano recommends it as an antidote for strychnine; with the previous administration of erytherine in 6 decigram doses, poisonous doses of strychnine, he says, may be taken without any danger.

BUTEA FRONDOSA, *Roxb.*

Fig.—*Roxb. Cor. Pl.*, 21, *t.* 21; *Bentl. and Trim.*, *t.* 79. Bastard teak (*Eng.*), Butéa touffu (*Fr.*).

Hab.—Plains of India. The flowers, leaves, seeds and gum.

Vernacular.—Palás, Dhák (*Hind.*), Palásha (*Mar.*), Khákar (*Guz.*), Pálásh (*Beng.*), Purashu, Murukkan-Maram (*Tam.*), Modugachettu, Palàshamu (*Tel.*), Muttaga-mara (*Can.*).

The seeds, Palás-ke-binj (*Hind.*), Murukkan-virai (*Tam.*), Moduga-vittula (*Tel.*), Muttaga-bija (*Can.*), Palásha-che-bi (*Mar.*), Paláspáparo (*Guz.*).

The gum, Palás-ki-gond, Kamarkas (*Hind., Beng.*), Palásha-gonda (*Mar.*), Khákar-no-gond, Kakria-gond (*Guz.*), Murukkan-pishin (*Tam.*), Moduga-banka (*Tel.*), Muttaga-gonda (*Can.*)

History, Uses, &c.—This tree has long been known to the Hindus under the Sanskrit name of Palásha, as possessing valuable medicinal properties. It is also a sacred tree, being called the treasurer of the gods and of sacrifice; from its wood are made sacred utensils and the staff of the Brahmin which is placed in his hand on the day of the Sodmunj. The red flowers are offered in the temples at the bloody sacrifices of the goddess Káli. The leaf, like that of *Erythrina indica*, is supposed to represent the Hindu trinity, and is used for making

the platters required at the Chaul ceremony, when the last tuft of hair being removed, the Brahmin boy becomes a Sádhu and must eat from a leaf platter (Brahma-pattra).

The dry twigs of the plant called Samidhás are used to feed the *Hom*, or sacred fire. The tree is also known in Sanskrit as Lâkshataru or "lac tree," because large quantities of lac are collected from its branches. Its flowers are likened by the Buddhists to penitents dressed in red. A strophe of the Saptashataka says—"In the spring the earth shines with the flowers of the Palasha as if it were covered with Bhikshus." It is the anthropogonic tree of several castes. In the Bhavaprakasa the use of the seeds of Palása as an aperient and anthelmintic is noticed; they are directed to be beaten into a paste with honey for administration. Sárangadhara also recommends them as an anthelmintic. The use of the gum as an external astringent application is mentioned by Chakradatta; it is directed to be combined with other astringents and rock salt. He recommends this mixture as a remedy for pterygium and opacities of the cornea. The author of the Makhzan-el-Adwiya describes the leaves of Palás as very astringent, tonic, and aphrodisiac, and says that they are used to disperse boils and pimples, and are given internally in flatulent colic, worms and piles. The flowers are astringent, depurative, diuretic and aphrodisiac; as a poultice they are used to disperse swellings and promote diuresis and the menstrual flow. The seed is anthelmintic, and, combined with astringents and rock salt, as already mentioned, is used to remove white spots from the cornea. (Cf. *Makhzan, article Palás.*) Ainslie notices the use of the seeds by Tamil practitioners as an anthelmintic, in doses of a tablespoonful and a half twice daily, both in cases of tapeworn and ascarides. He quotes Roxburgh's description of the gum and flowers, but remarks that the natives appear to make no use of either of them. From the Hortus Malabaricus, it appears that the bark is given in conjunction with ginger in cases of snake-bite. Dr. Sherwood informed Ainslie that a decoction of the seeds with nitre was prescribed in gravelly complaints by native practitioners. In India at the present

time the gum is much used as a substitute for kino by natives and Europeans with satisfactory results. We have tried the seeds as an anthelmintic, and are inclined to think favourably of them; they have an aperient action. An infusion of two or three seeds is used for this purpose. When pounded with lemon-juice and applied to the skin they act powerfully as a rubefacient. We have used them successfully for the cure of the form of herpes known as Dhobie's itch. In the Concan a poultice of the flowers boiled in water is applied to the abdomen in difficult micturition, and two tolás of the water with nitre is given internally. Dr. Fancourt Willis informs us that the Arab horse-dealers put one seed into each feed of corn to keep their horses in condition.

Description.—The leaves are spreading and ternate, from 8 to 16 inches long, leaflets emarginate, or rounded at the apex, leathery above, shining and pretty smooth below, slightly hoary, entire, the pair are obliquely oval, from four to six inches long, and from three to four and a half broad, the exterior one obovate, and considerably larger than the lateral ones; the flowers are very large, papilionaceous, their colour a beautiful deep red, shaded with orange and silver coloured down*; seeds flat, about 1¼ inch long, 1 inch broad and 1-16th inch thick; testa dark reddish brown, thin, smooth, veined; hilum prominent; cotyledons large and leafy, surface veined; radicle small, taste a little acrid. The gum occurs in commerce as small, flattish or angular fragments of a very deep ruby colour, and unless held between the eye and the light seems to be opaque; it is mixed with numerous small particles of light grey corky bark; the taste is purely astringent. The secretion in a fresh state is ruby-coloured, and is soluble for the most part in water; when kept for some time

* Amir Khusru, the Turkoman poet, likens the flowers to a lion's claws stained with blood—

پنجہ کشادہ گل لعل پلز . غرق خون ناخن شیرپلر

The Paleh expands its clutches of red flowers like the claws of the fierce lion steeped in blood.

it darkens in colour, and swells up like bassorin, and only partially dissolves. Both fresh and commercial samples behave in the same manner with rectified spirit, giving up less than half their weight of tannin to the solvent, and leaving a large quantity of insoluble gum.

Chemical composition.—According to Hanbury, Butea gum yields 1·8 per cent. of ash, and contains 13·5 per cent. of water. Ether removes from it a small quantity of pyrocatechin. Boiling alcohol dissolves it to the extent of 46 per cent; the solution which is but little coloured produces an abundant greyish green precipitate with perchloride of iron, and a white one with acetate of lead. It may be hence inferred that a tannic acid, probably kino-tannic acid, constitutes about half of the weight of the drug, the remainder being a soluble mucilaginous substance. Butea kino submitted to dry distillation yields pyrocatechin. According to Eissfeldt it does not contain pyrocatechin, but yields it on dry distillation.

Roxburgh states that he obtained an extract by evaporating the juice of the flowers diluted with alum water and rendered clear by depuration, which proved a brighter water colour than gamboge. He further says that infusions of the dried flowers yielded an extract very little, if any thing, inferior to that made from the fresh juice. These extracts after being kept for a year remained perfectly bright. The flowers are used as a dye stuff in Bengal and are exported to the N.-W. Provinces. The oil of the seeds is yellow, sp. gr. 0·917; it is nearly tasteless, and solidifies at 10°. (*Lepine.*) Brannt gives 0·927 as the specific gravity The seeds have been examined by N. Waeber (*Pharm. Zeitschr. für Russland*, 1886); the results of the analysis are as follows, alkaloids and glucosides were not found—

Moisture		6·62
Ash		5·14
Fat		18·20
Wax soluble in ether		0·25
Albuminoids	sol. in water	9·12
,,	sol. in soda	1·95

Albuminoids insol. in water and soda ...	8·49
Substance apparently nitrogenated, soluble in alcohol	0·82
Mucilage	2·28
Glucose..	6·87
Organic acids	4·00
Other substances soluble in water.........	2·16
Metarabic acid and phlobaphene	10·10
Cellulose	3·80
Other insoluble substances..................	22·20

Commerce.—The gum, seeds and dried flowers are articles of commerce. Value, gum, 3 as. per lb.; seeds, Rs. 2½ per maund of 37½ lbs.

Butea superba, *Roxb.*

Cor. Pl. 23, *t.* 22.

Hab.—Concan, Bengal, Orissa, Burma.

Vernacular.—Tiwat, Tiwas, Palás-vél (*Mar.*), Palás-lata (*Hind.*, *Beng.*), Kodi-murukkan (*Tam.*), Tige-moduga (*Tel.*), Balli-muttaga (*Can.*), Vel-khákar (*Guz.*), is a scandent shrub very closely resembling *B. frondosa,* and like that plant yielding a kino-like gum. As a remedy for the poisonous bites of animals the people of the Concan use the root with an equal proportion of the root of *Nyctanthes* and *Woodfordia floribunda,* the seeds of *Cassia Tora* and *Vernonia anthelmintica,* and the stem juice of *Trichosanthes palmata* made into a paste with cow's urine, as a local application, and administer *Aristolochia indica* internally. In the heat eruptions of children the leaf-juice is given with curds and yellow zedoary. Mr. Prebble informs us that **B. minor** also yields a kino.

CLITORIA TERNATEA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1542. Winged-leaved Clitoria (*Eng.*), Clitoria de Ternate. (*Fr.*).

Hab.—From the Himalayas to Ceylon and Burma. The root and seeds.

Vernacular.—Kava-thenthi (*Hind.*), Aprajita (*Beng.*), Kájali, Gokaran (*Mar.*), Garani (*Guz.*), Kakkanan-kodi (*Tam.*), Dintana (*Tel.*), Karnike (*Can.*).

History, Uses, &c.—The plant is called in Sanskrit Aparajita or Gokarna, both are names for Shiva, to whom the flowers are sacred in common with those of the species of Sesbania having flowers of a somewhat similar shape; typical of his representation as the Ardha-nári or hermaphrodite god. Rumphius calls Clitoria, Flos cæruleus, and says that in Ternate it is known as *Saja Cotele* and *Bokyma Cotele, i.e.* Flos clitoridis and Clitoris principissæ; he gives Fula criqua as the Portuguese name. (*Hort. Amb.* vii., 30.) Sanskrit works on Materia Medica describe the root as aperient and diuretic, and direct it to be used in combination with other diuretics and laxatives in ascites and enlargements of the abdominal viscera. The Mahometans have given it the name of Mázeriyun-i-Hindi (Indian Mezereon) on account of its purgative and diuretic properties. We may mention here that their mezereon is used to remove dropsical enlargements of the abdomen, and is not the same drug as the mezereon of our *Pharmacopæia.*

Ainslie mentions the use of the root in croup, given with the object of causing nausea and vomiting. In the Concan two tolás of the root-juice are given in cold milk to remove the phlegm in chronic bronchitis; it causes nausea and vomiting. The juice of the root of the white-flowered variety is blown up the nostrils as a remedy for hemicrania. The author of the Bengal Dispensatory after extensive experiments denies its emetic properties, but says that an alcoholic extract proved a brisk purgative in doses of from 5 to 10 grains; he found it however to give rise to griping and tenesmus, and does not recommend its use. Mr. Moidín Sheriff speaks highly from personal experience of the root bark in doses of from one to two drachms in infusion as a demulcent in irritation of the bladder and urethra. It acts at the same time as a diuretic and in some cases as a laxative. The seeds appear not to have been used medicinally by the natives, but attention

has been drawn to their purgative properties in the *Pharmacopœia of India,* and there would seem to be but little doubt that their action is mild and safe; they should be administered in combination with twice their bulk of acid tartrate of potash and a little ginger, and in the same doses as compound jalap powder. The seeds were first brought to England from the island of Ternate, one of the Moluccas, hence the specific name of the plant. Haines has recommended a syrup of the deep blue flowers as a colouring agent, and a tincture as a substitute for litmus.

Description.—The fresh root is white, fleshy, often one inch or more in diameter, but pieces the size of a quill are preferred; it has an acrid taste. The root bark is soft, thick and fibrous and easily separated; the central portion of the root is composed of very large pitted vessels easily visible to the naked eye. The seeds are rather more than 2-8ths of an inch long and resemble vetch seeds; they are mottled green and black. The testa is hard and contains two cotyledons made up of elongated thin-walled cells full of large starch granules; they have an acrid, bitter taste.

Chemical composition.—Ether dissolves out a yellow resin soluble in alcohol and alkaline solutions, and apparently crystalline when carefully evaporated. Subsequent treatment of the drug with rectified spirit removes an amorphous, reddish-brown acid resin and a quantity of alkaline chlorides which leave a deposit of cubical crystals on concentrating the clear liquor. This resin forms 4 per cent. of the root bark. It is soluble in alkalies with a red colour, and is reprecipitated by acids with discharge of the colour. It forms brown solutions with concentrated nitric and sulphuric acids. Although this resin is not dissolved out of the drug by ether, a soda solution precipitated by acid and shaken up with ether leaves no insoluble residue. The root bark contains starch, and a tannin giving a blue-black precipitate with ferric chloride, and yields 12 per cent. of ash. No alkaloid was detected in either the ethereal, alcoholic, or aqueous extracts.

The seeds of **C. ternatea** contain 12·8 per cent. of moisture and 6 per cent. of ash. Ether removes a bland greenish fixed oil and a light brown resin. Alcohol extracts a bitter acid resin, apparently the active principle, a tannic acid giving a blue-black colour with ferric chloride, and a large proportion of glucose. Water alone dissolves the acrid principle, which is precipitated by iodine solution, readily decomposes with the formation of sugar, and in other respects resembles a glucoside.

Commerce.—The dried root is to be found in the shops sometimes.

Dalbergia sympathetica, *Nimmo, Jour. Linn Soc. iv., Suppl.* 42, a plant of the Western Peninsula. Pentgul (*Mar.*), Titábli (*Goa.*).

The leaves are used in Goa as an alterative. It is a very remarkable scandent shrub; the stem studded thickly with large blunt thorns, often nine inches long, some of them contorted so as to assist in supporting it upon high trees; the leaves are pinnate, 4 to 6 inches long, the leaflets delicate, obtuse or emarginate, ½ to 1 inch long, thinly silky at first, especially beneath; the flowers are in short, axillary cymes; calyx 1-12th of an inch long, silky, with a pair of small obtuse, adpressed bracteoles; teeth short, obtuse; corolla twice the length of the calyx, yellowish white; pod generally one-seeded, membranous, obtuse, about 2 inches long and ¾ of an inch broad with an unusually short stalk. The bark is used as a *lép* to remove pimples. The foliage resembles that of the Tamarind, and is eaten by cattle. The flowers appear in February and March. Rheede's name for the plant is *Ana Mullu.*

In the Concan the juice of the leaves of *D. volubilis, Roxb.*, Alei (*Mar.*), is applied to aphthæ, and used as a gargle in sore throat. The root-juice with cummin and sugar is given in gonorrhœa.

PTEROCARPUS SANTALINUS, *Linn. fil.*

Fig.—*Bedd. Fl. Sylv., t.* 22; *Bentl. and Trim., t.* 82. Red Sanders (*Eng.*), Santal rouge (*Fr.*).

Hab.—Western Peninsula. The wood.

Vernacular.—Ragat-chandan, Lal-chandan (*Hind.*), Rakta-chandan, Tambara chandana (*Mar.*), Shen-shandanam (*Tam.*), Erra-gandhapu-chekka, Rakta-gandham (*Tel.*), Rakta-candana, Kempu-gandha-chekke (*Can.*), Rakta-chondon (*Beng.*), Ratánjli (*Guz.*).

History, Uses, &c.—According to Sanskrit writers there are three kinds of sandalwood, Srikhanda or white, Pitachandana or yellow, and Raktachandana or red. The first two are the dark and light-coloured wood of *Santalum album.* Upon the subject of red sandalwood, Dutt (*Materia Medica of the Hindus*, p. 154,) has the following remark:—"It has been a question how the wood of *Pterocarpus santalinus*, which is nearly inodorous, came to be called by the name of Rakta-chandana in Sanskrit and the vernaculars of India. I am inclined to think that it is owing to the similarity in the uses to which the Hindus put both these articles. Both sandalwood and red sandalwood are rubbed on a piece of stone with water, and the emulsions used after bathing and in religious services." Hindu physicians consider red sandalwood to be astringent and tonic; they use it as a cooling application to inflamed parts and to the head in headache; as an external application it is supposed to be more powerful than white sandalwood, given internally to be less, so the two are often combined, and are considered to have similar properties. Mahometan writers follow the Hindus in describing the three kinds of sandalwood and their uses. The author of the *Shafa-el-askam* says that in bilious fluxes white sandal is used, when blood is being passed red sandal, and when the stools contain both bile and blood the two woods are combined. This treatment must be based upon the doctrine of signatures. Red sanders wood is well known in Europe as an ingredient in French polish.

Description.—The wood sinks in water; it is dark red with black veins; thin shavings appear blood red with veins of a lighter tint if the section is a transverse one. The cells of the parenchymatous layers which connect the vascular bundles contain very large crystals of oxalate of lime visible to the naked eye; all parts of the wood are full of colouring matter.

Chemical composition.—Red sandalwood was first examined by L. Meier, who obtained from it a red crystalline principle to which he gave the name of *Santaline.* Meier obtained this substance by exhausting the wood with ether, the extract thus obtained was then washed with water, dissolved in alcohol, and the alcoholic solution precipitated by acetate of lead, on the removal of the lead the liquid yielded the santaline.

Weyermann and Hæffely assigned the formula $C^{15} H^{14} O^{5}$ to this resinoid substance.

Weidel (1870) exhausted the wood with boiling water containing a little potash and obtained by means of hydrochloric acid a red precipitate, which was redissolved in boiling alcohol and then furnished *colourless* crystals of *Santal* $C^{8} H^{6} O^{3} + \frac{1}{2} H^{2} O$, which when acted upon by alkalies yielded protocatechuic acid and carbonic acid, like piperonal, with which it is isomerous. Upon completely exhausting sandalwood, Weidel also obtained a partially crystalline red substance distinct from colourless santal and from the santaline of Meier; to this substance he assigned the formula $C^{14} H^{12} O^{4}$. In 1878, Franchimont and Sicherer isolated from sandalwood an amorphous principle melting at about 104° and having the composition $C^{17} H^{16} O^{6}$. Three years previous to the experiments of Franchimont, P. Cazeneuve by exhausting with ether at 56° an intimate mixture of the powdered wood with slaked lime, had obtained a finely crystalline body having the formula $C^{12} H^{10} O^{3}$. This substance, which differed from those already mentioned, was in reality a mixture which Cazeneuve and Hugonnenq in 1887 separated into pterocarpine and homopterocarpine, the latter substance being very soluble in cold bisulphide of carbon, whilst the former is only so in excess of

boiling bisulphide. Pterocarpine is a white crystalline substance insoluble in water and cold alcohol, but soluble to some extent in boiling alcohol, it is slightly soluble in boiling ether, which deposits it on cooling in crystalline flakes; it crystallizes from chloroform in fine prisms. A solution of 4·64 grms. in 100 c.c. of chloroform, is strongly levogyre [a]j = — 211°., heated to 145° it softens and melts at 152°, turning slightly yellow. Formula $C^{10} H^{8} O^{5}$; it is neutral to reagents; insoluble in acids and boiling liquor potassæ, but is acted upon by fused potash evolving a coumarin odour. Nitric acid forms with it a green solution.

Homopterocarpine has the same general properties. Formula $C^{12} H^{12} O^{3}$. M M. Cazeneuve and Hugonnenq consider that both of these substances are allied to the Coumarins.

Commerce.—Red sandalwood comes from Southern India, the felling of the trees is under Government control, and they yield a considerable revenue. It is imported into Bombay and Calcutta from the Malabar Coast. Value, Rs. 15 to 28 per kandy of 7½ cwts. The variation in price depends upon the quantity in the market.

PTEROCARPUS MARSUPIUM, *Roxb.*

Fig.—*Roxb. Cor. Pl. ii., t.* 116; *Bedd. Fl. Sylv., t.* 21; *Bentl. and Trim., t.* 81. Indian Kino tree (*Eng.*), Ptérocarpe à bourse (*Fr.*).

Hab.—Western Peninsula, Ceylon. The gum.

Vernacular.—Bija, Bijasár (*Hind.*), Bibla, Honné (*Can.*) Asán (*Mar.*), Vengai-maram (*Tam.*), Peddagi (*Tel.*).

History, Uses, &c.—Neither Hindu or Mahometan medical writers appear to notice Malabar kino. Rumphius (iii., 24,) calls the tree *Pterocarpus indicus*, and remarks that the gum looks like dried blood, and cures diarrhœa; he also says that the bruised leaves are applied to boils, sores, and skin eruptions.

Ainslie notices the use of the gum by the natives on the Coromandel Coast as a remedy for toothache, but does not call it kino, and it would appear not to have been an article of export to Europe in his time. From the *Pharmacographia* we learn that kino originally came from the river Gambia in West Africa under the name of *Gummi rubrum astringens Gambiense,* and that it was produced by a tree called in the Mandingo language *Kano,* and which was afterwards identified with the *Pterocarpus erinaceus* of Poiret. In the *Edinburgh Dispensatory* of 1803, kino is described as coming from Africa and Jamaica, but in the 1811 edition, Duncan says that the African drug is no longer to be met with, its place being supplied by kinos from Jamaica, the East Indies, and New South Wales. After this date the East Indian drug appears to have been principally used, and when Wight and Royle (1844-46) proved its botanical origin it became recognised as the legitimate kino of the principal Pharmacopœias of Europe. A description of its collection on the Malabar Coast will be found in the *Pharmacographia.* In the Canara District of the Bombay Presidency it is collected in little cups made with leaves, and consequently assumes the form of concavo-convex cakes, 3 to 4 inches in diameter; these are always broken up and garbled by the wholesale dealers. Malabar kino is mostly reserved for the European market, there is little demand for it in native practice, Dragon's blood and Butea kino taking its place. The bark of the tree is used in Goa as an astringent, but the gum is not collected. Kino is more lenitive than other astringents, in consequence, probably, of the phlobophene it contains; it is chiefly used in the treatment of diarrhœa and pyrosis.

Description.—Kino as offered for sale is in blackish-red angular fragments full of cracks. If a thin fragment is held between the eye and the light it is seen to be of a rich garnet colour. The greater part of it is soluble in cold water and all in boiling water, but a portion is deposited on the water cooling. Rectified spirit dissolves kino, forming a deep red tincture which often gives trouble by becoming gelatinous if

kept for any time. The addition of a little glycerine will prevent this.

Chemical composition.—The following account is extracted from the *Pharmacographia*:—"Cold water forms with kino a reddish solution, which is at first not altered if a fragment of ferrous sulphate is added. But a violet colour is produced as soon as the liquid is cautiously neutralized.

"This can be done by diluting it with common water (containing bicarbonate of calcium) or by adding a drop of solution of acetate of potassium. Yet the fact of kino developing an intense violet colour in presence of a protosalt of iron, may most evidently be shown by shaking it with water and iron reduced by hydrogen. The filtered liquid is of a brilliant violet, and may be evaporated at 100° without turning green; the dried residue even again forms a violet solution with water. By long keeping the violet liquid gelatinizes. It is decolorized by acids, and turns red on addition of an alkali, whether caustic or bicarbonated. Catechu, as well as crystallized catechin, show the same behaviour, but these solutions quickly turn green on exposure to air.

"Solutions of acids, of metallic salts, or of chromates produce copious precipitates in an aqueous solution of kino. Ferric chloride forms a dirty green precipitate, and is at the same time reduced to a ferrous salt. Dilute mineral acids or alkalies do not occasion any decided change of colour, but the former give rise to light brownish red precipitates of kino-tannic acid. By boiling for some time an aqueous solution of kino-tannic acid, a red precipitate, kino-red, is separated.

"Kino in its general behaviour is closely allied to Pegu catechu, and yields by similar treatment the same products, that is to say, it affords pyrocatechin when submitted to dry distillation, and protocatechuic acid together with phloroglucin when melted with caustic soda or potash.

"Yet in catechu the tannic acid is accompanied by a considerable amount of catechin, which may be removed directly by exhaustion with ether. Kino, on the other hand, yields to

ether only a minute percentage of a substance, whose scaly crystals display under the microscope the character of pyrocatechin, rather than that of catechin, which crystallizes in prisms. The crystals extracted from kino dissolve freely in cold water, which is not the case with catechin, and this solution assumes a fine green if a very dilute solution of ferric chloride is added, and turns red on addition of an alkali. This is the behaviour of catechin as well as of pyrocatechin; but the difference in solubility speaks in favour of the crystals afforded by kino being pyrocatechin rather than catechin.

"We thought pyrocatechin must also occur in the mother-plant of kino, but this does not prove to be the case, no indication of its presence being perceptible either in the fresh bark or wood Etti (1878) extracted from kino colourless prisms of kinoïn by boiling the drug with twice its weight of hydrochloric acid, about 1·03 sp. gr. On cooling, kino-red separates, very little of it remaining in solution together with kinoïn. The latter is extracted by exhausting the liquid with ether, which by evaporation affords crystals of kinoïn. They should be recrystallized from boiling water; they agree with the formula $C^{14} H^{12} O^{6}$, which is to be regarded as that of a methylated gallic ether of pyrocatechin, *viz.*, $C^{6} H^{4} (OCH^{3}) C^{7} H^{5} O^{5}$. Kinoïn by heating it to 130° C. gives off water and turns red; $2C^{14} H^{12} O^{6} = O H^{1} C^{28} H^{22} O^{11}$. The latter product is an amorphous mass agreeing with kino-red; by heating it at 160 to 170° it again loses water, thus affording another anhydride. Etti succeeded in preparing methylic chloride, pyrocatechin, $(C^{6} H^{4} OH)^{2}$, as well as gallic acid, $C^{7} H^{6} O^{5}$, by decomposing kinoïn.

"We have prepared kinoïn from Australian kino, but failed to obtain it from Malabar kino, which Etti says he used. Kino affords about 1½ per cent. of kinoïn. The solutions of kinoïn turn red on addition of ferric salts. Commercial kino yielded us 1·3 per cent. of ash." (*Pharmacographia, 2nd Ed.*, p. 196.)

Commerce.—Kino is chiefly collected on the Malabar Coast, and exported from Cochin direct to Europe. A false kino

similar in appearance to that of Malabar, but very insoluble in water and spirit; has been recently met with in the Bombay market. Good kino should dissolve readily in rectified spirit.

PONGAMIA GLABRA, *Vent.*

Fig.—*Jard. Malm.*, *t.* 28; *Wight Ic.*, *t.* 59; *Bedd. Fl. Sylv.*, *t.* 177.

Hab.—India, most abundant near the coast.

Vernacular.—Karanj, Kiramál (*Hind.*), Dahar-karanja (*Beng.*), Karanja (*Mar.*), Pungam-maram (*Tam.*), Ranagu, Kanuga-chettu (*Tel.*), Honge (*Can.*).

History, Uses, &c.—This is a handsome flowering tree with foliage like the Beech. Sanskrit writers call it Karanja and Naktamála or Naktamálaka, "garland of the night," and in Hindi it is sometimes called Sukhchain, "affording perfect satisfaction to the senses"; indeed, it well deserves these names, as nothing can be more beautiful than its drooping branches of shining green leaves laden with racemes of rose-coloured flowers. The seeds, leaves, and oil are used in Hindu medicine as a remedy for skin diseases and rheumatism and to destroy worms in sores. Chakradatta mentions a paste made of the seeds along with those of *Cassia Tora* and the root of *Saussurea Lappa* as a useful application to skin diseases. He also gives prescriptions for a compound oil and ghrita to be used for the same purpose (*see Dutt's Mat. Med.*, p. 153), where the original prescriptions are given with a translation.

Rheede notices the use of a bath prepared with the leaves, to remove rheumatic pains; and they appear to be in general use for this purpose. Ainslie says that the juice of the root is used for cleansing foul ulcers, and closing fistulous sores. He also notices the oil and its use in itch and rheumatism. Gibson speaks very highly of the oil as a remedy in scabies, herpes, and other cutaneous diseases of a similar nature; it should be mixed with an equal quantity of lemon juice and be well shaken,

when it forms a rich yellow liniment which we have used successfully in porrigo capitis, pityriasis and psoriasis. In leprosy the natives prescribe the leaves with those of Plumbago, along with some pepper and salt, to be powdered and given in curds. Karanj is also an ingredient in several complicated prescriptions for epilepsy and abdominal enlargements. Dr. P. S. Mootooswamy mentions the use of the juice of the root with cocoanut milk and lime water as a remedy for gonorrhœa in Tanjore, and of the leaves (Ponga-illai, Tamil) in flatulency, dyspepsia, and diarrhœa. He also informs us that broken rice is boiled with the leaves and those of *Morinda citrifolia*, dried in the shade, cleaned and crushed, and from this preparation a thin salt gruel is made to feed young children with instead of cow's milk, which is supposed to cause glandular enlargements of the abdomen. He has noticed the use of the flowers as a remedy for diabetes, and of the pods worn round the neck as a protective against whooping cough. (*Indian Med. Gaz.*, 1888.) Dr. B. Evers has seen the seeds administered internally for the last named affection. The oil is in general use amongst the agricultural classes as a lamp oil.

Description.—Leaves pinnate, from 6 to 18 inches long, leaflets opposite, 2 to 3 pairs and an odd one, oval, pointed, entire, smooth and shining, subcoriaceous, 2 to 4 inches long, taste bitter; pod woody, ovate, compressed, glabrous, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick, $1\frac{1}{2}$ to 2 inches long, apex thick and blunt, point decurved, very short, it generally contains one perfect and one abortive seed; seed compressed, of the shape and size of a broad bean; testa thin, smooth, veined, light-red; cotyledons very oily, bitter. The bark has a thin ashy-grey outer layer, which readily peels off; when this is removed, the surface is seen to be green with white transverse markings. The substance of the bark is tough with a white granular fracture; odour mawkish; taste bitter and somewhat aromatic, with a peculiar pungency. Starch and rhomboid crystals are observed under the microscope. The root bark is of a rusty-brown externally, yellow within. All parts of the plant when crushed afford a yellow juice.

Chemical composition.—According to Lepine (*Pharm. Journ.* (3) XL. 16.) the seeds yield 27 per cent. of a yellow oil, having a specific gravity of 0·945, and solidifying at 8° C.

The oil which we have examined (called Hooge oil in Mysore) and expressed purposely from fresh seeds, was thick, of a light orange-brown colour, and bitter taste. The specific gravity at 18° C. was 0·9358. It yielded 93·3 per cent. of fatty acids melting at about 30°. With sulphuric acid it became yellow with orange streaks, and when stirred formed an orange-red mixture, which after standing became yellow. With nitric acid it formed an orange emulsion. With the elaïdin test it remained liquid for several hours, and was of the colour and consistence of honey after two days. The fresh oil deposits solid white fats if kept at the temperature of 16° for a few weeks, and the clear oil then has the specific gravity of 0·935. The bitter principle of the oil appears to reside in a resin and not in an alkaloid, as in the case with Margosa oil.

The bark contains a bitter alkaloid, soluble in ether, alcohol, and water; also an acid resin of a greenish-brown colour soluble in ether. The alcoholic extract is composed of a substance analogous to quinovin together with sugar. The watery extract contains much mucilage, which is gelatinized by ferric chloride. A decoction of the bark gives a blue-black colour with iodine solution; no indication of the presence of tannin could be obtained from any part of the bark.

DERRIS ULIGINOSA, *Benth.*

Fig.—*Wt. in Hook. Bot. Misc. iii., Suppl. t.* 41.

Hab.—Eastern Himalayas, Western Peninsula, Ceylon.

Vernacular.—Pánlata (*Beng.*), Kájarvel, Kirtána (*Mar.*).

History, Uses, &c.—This woody climber is the most widely-spread species of the genus, and is worthy of notice on account of the activity of its bark as a fish poison, for which purpose it is used in Zambesi-land. In India it is known to

act as a poison upon worms and the larvæ of insects which trouble the cultivator, whence the Marathi name *Kirtána,* or "worm-creeper."

The natives of Tanjore use it medicinally. Dr. P. S. Mootooswamy (*Indian Med. Gaz.*, 1888,) mentions a medicinal oil, in which it is an ingredient, as used internally and applied externally in paralysis, rheumatism, dysmenorrhœa, &c.; but as this ghrita (oil) contains such active ingredients as Plumbago root, Asafœtida, and Garlic, it is difficult to tell how much of its efficacy in due to the Derris.

Description.—The plant is a woody climbing shrub with pinnate leaves and pink flowers. The stem bark is dark brown and scabrous from the presence of numerous little round white corky lenticels, the bark of the root is of a lighter colour, scurfy and thickly studded with large transverse corky warts, its substance is of a greenish colour; taste acrid and astringent. The powder of the bark excites sneezing.

Chemical composition.—A proximate analysis of the bark reveals the presence of a neutral crystalline principle, a wax and two resins in the ether extract; two colouring matters, an alkaloid and glucose in the alcoholic extract; an acrid glucoside allied to saponin, together with gum in the aqueous extract, and 8 per cent. of mineral matter. The bitterish alkaloid gives a fine red colour with sulphuric acid and a violet colour with oxidizing agents; it is associated with the colouring matter soluble in water, which is of an acid nature and strikes a deep reddish-brown with ferric chloride, and a reddish pink with ferrous sulphate. The glucoside is precipitated with barium hydrate with colouring matter, and the latter is left in an insoluble condition on dissolving the barium compound in hydrochloric acid; on boiling this solution the decomposition was readily effected with the formation of glucose and an insoluble body differing from sapogenin in its appearance and solubility in spirit. The resin, more soluble in rectified spirit, was dark reddish brown and freely soluble in alkali; the less soluble resin was light brown, brittle, and soluble

only in a large quantity of alkali; they were both acid in reaction.

Tourhi Pods.—These dried pods, which are sold in the bazars of Bengal, are apparently those of a species of Derris; they vary much in size, being ¾ to 2 inches in length, and from ¼ to ½ an inch in breadth. They are brittle and of a brown colour with a prominent dorsal suture.

The pods are astringent, and when powdered are used as a tooth powder and to stain the teeth. A decoction is used as an astringent injection in leucorrhœa, but their principal use is in the preparation of writing ink.

Chemical composition.—The pods with their seeds reduced to powder contained 4·73 per cent. of moisture, and 2·86 per cent. of ash; a slight trace of manganese was present.

With the exception of a very large amount of astringent matter giving a blackish coloration with ferric salts, and a resinous principle soluble in chloroform, and affording a bright yellow coloration with alkalies, nothing special was detected. No glucoside was present.

SESBANIA GRANDIFLORA, *Pers.*

Fig.—*Rheede, Hort. Mal. i., t.* 51. *Syn.*—Agati grandiflora.

Hab.—W. Peninsula. The bark and flowers.

Vernacular—Agásta (*Mar.*), Avisi (*Tel.*), Agátti (*Tam.*), Bak (*Beng.*), Agasthio (*Guz.*), Basna (*Hind.*), Agashi (*Can.*).

History, Uses, &c.—A native of the Eastern Islands, but cultivated in gardens all over India, and now quite naturalised. In Sanskrit it is called Agasti, Vranári, Vaka and Sthúla-pushpa, or "large-flowered." It is named Agasti after a rishi or sage of that name, the author of several Vedic hymns, who is said to have been the son of both Mitra and Varuna by Urvasi,* and to have conquered and civilised

* Urvasi (hot desire), an Apsaras or nymph of Indra's heaven. According to local tradition the sage was not born of her body, but from the lust excited by her beauty. (*Ainslie.*)

Southern India. He also wrote on medicine, and his healing spirit is said still to haunt the mountains of Courtallum. To the present day his works are held in the highest estimation in the South of India. The flowers are sacred to Shiva and are supposed to represent the male and female generative organs.

The bark is very astringent, but not bitter, as stated in the *Pharmacopœia of India,* where it is recommended as a tonic by Dr. Bonavia. The statement that it is a bitter tonic occurs also in the *Bengal Dispensatory.* In Bombay the leaves or flowers are made use of by the natives, their juice being a popular remedy in nasal catarrh and headache; it is blown up the nostrils and causes a very copious discharge of fluid, relieving the pain and sense of weight in the frontal sinuses.* The root of the red flowered variety, rubbed into a paste with water, is applied in rheumatism; from 1 to 2 tolás of the root-juice are given with honey as an expectorant in catarrh; a paste made of the root with an equal quantity of Stramonium root is applied to painful swellings. The flowers are cooked and eaten as a vegetable. The leaves are said to be aperient. Rumphius states that a poultice of the leaves is so popular a remedy in Amboyna for bruises, that the tree has become notorious as the "solatium et auxilium illorum qui vapulantur," and people who plant it near their houses are laughed at on this account. It is a curious coincidence that the Sanskrit name Vranári signifies "enemy of sores" (Vrana-ari).

Description—A tree of very short duration, attaining a height of about 30 feet in a few years and then dying. The leaves are abruptly pinnated, leaflets 21 pairs or fewer, oblong-ovate, 1 to 1½ inch long; taste a little acid and astringent. The calyx is campanulate, two-lipped, flowers papilionaceous, white or red, very large and fleshy in 2 to 4 flowered axillary racemes, taste mucilaginous and bitterish, legumes pendulous, very long,

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* This kind of medicament is the ρίνεγχυτον of Galen. In Scrib. Larg. Comp. 7, we read:—"Per nares ergo purgatur caput iis rebus infusis per cornu quod rhynenchytes vocatur; Hederæ succo per se, vel betæ succo, cum exiguo flore æris, vel cyclamini succo mixto lacte aut aqua pari mensura."

slightly flattened, contracted between the seeds. The bark is much fissured longitudinally, of a greyish-brown externally, the dry suber nearly equal to the living portion in thickness; in the fissures may be seen numerous small tears of a garnet-red when fresh, but soon becoming almost black by exposure to the air. The outer portion of the living bark is of a red colour, and is loaded with the same kind of gum in a soft state.

Chemical composition.—Tears of the red gum which adhere to the bark merely softened in water, they were also insoluble in boiling water, and in cold and boiling alcohol. They were slowly dissolved by boiling with dilute alkali, giving a brown solution when ammonia was used, and a deep claret with soda. The alkaline solution neutralized with acetic acid gave brown flocculent precipitates with lead acetate, alum, and salts of iron. A large excess of acid did not cause complete separation of the colouring matter. A filtered decoction of the bark gave a blue-black colour with ferric chloride, and a deposit with rectified spirit, showing the presence of tannin and gum.

SESBANIA ÆGYPTIACA, *Pers.*

Fig.—*Rheede, Hort. Mal. vi., t.* 27; *Wight Ic., t.* 32.

Hab.—India.

Vernacular.—Jét, Résin (*Hind.*), Jayanti (*Beng.*), Champai (*Tam.*), Shevári (*Mar.*), Somanti (*Tel.*), Karijinange (*Can.*).

History, Uses, &c.—This plant, in Sanskrit Jaya (victorious), Jayanti (daughter of Indra), Vaijayanta (banner of Indra), Nádeyi (river-born), is extensively cultivated in India, where the stems are used as a substitute for bamboos. It is the *Kedangu* of Rheede and *Emerus* of Burmann. The Hindus have a superstition that the sight of the seeds will remove the pain of scorpion stings; they also pound them and apply them locally as an astringent. The juice of the bark is given internally as an astringent, and Wight remarks that the

leaves are much used in poultices to promote suppuration. Forskahl calls the plant *Dolichos Saiseban*; it is the Saisabán of the Egyptians, who use the seeds medicinally on account of their astringent properties. Prosper Alpinus says of these seeds:—

"Et ut uno verbo dicam, in omnibus vacuationibus firmandis illorum seminum usum habent frequentissimum." Mir Muhammad Husain and others who describe the use of the seeds in India give a similar account of their medicinal properties. The generic name of the plant is Persian, and according to the Burhán, should be pronounced "Sīsĭbān." This the author of that work says is the same as Panjangusht (a plant generally identified with *Vitex Agnus-castus*) and called Hab-el-fakd by the Arabs. Here he agrees with Abu Hanifeh, who describes الفقد as a plant which is thrown into mead to make it strong, and is called in Persian Fanjangusht. On the other hand Ibn Arabi says El fakd is the Kushuth * (كشوث) and also a beverage (نبيذ) prepared from raisins and honey, into which the *fakd* has been thrown, to cause it to become strong. It seems probable that the Fakd of the Arabs was an astringent plant, which was used, like Acacia bark in India, for clearing spirituous liquor.

Description.—Sir W. Jones describes the flowers as varying in colour; in some plants, wholly yellow; in others, with a blackish-purple awning yellow within, and dark yellow wings tipped with brown; in some with an awning of the richest orange-scarlet externally, and internally of a bright yellow; wings yellow, of different shades; and a keel pale below, with an exquisite changeable light purple above, striated in elegant curves. The leaves are pinnate, 3 to 6 inches long, with from 9 to 15 pairs of linear-oblong leaflets. The seeds are oblong, somewhat kidney-shaped, and smooth and are contained in a tomentose pod, 6 to 9 inches in length.

* Kushuth is described as a parasitic plant, without root or leaves, and is generally supposed to be a kind of Cuscuta.

Chemical composition.—The seeds weigh on an average one centigram each; they have a bland taste with a peculiar odour, and are difficult to powder. A proximate analysis separated—

Fixed oil and odorous body	3·67
Resin, sugar, and organic acid	4·11
Mucilaginous matter, &c.	21·25
Ash	5·09
Organic residue	44·86

The organic acid gave a dark olive colour with ferric chloride, and was not precipitated from solution by gelatine. The colouring matter was insoluble in ether, alcohol and water, and was removed by diluted caustic soda; it was a fine red, and was entirely precipitated by acetic acid from its alkaline solution. The powdered seeds, burnt with soda-lime, afforded 4·01 per cent. of nitrogen, which is equivalent to 25·38 per cent. of proteids.

ASTRAGALUS SARCOCOLLA, *Dymock.*

Hab.—Persia. The gum.

Vernacular.—Anzerút (*Arab.*), Gújar (*Bom.*, a corruption of the Persian Gúzhad).

History, Uses, &c.—This drug, though still largely used in the East, is hardly known in Europe at the present time. Dioscorides informs us that Sarcocólla is the tear of a Persian tree, that it resembles powdered Frankincense, is of a reddish colour and bitterish taste, has the property of closing wounds and checking discharges from the eyes. It is an ingredient in plasters, and is adulterated with gum.*

Pliny writes to the same effect, and adds that it is valued by painters.† Ibn Sina says that it closes wounds without causing irritation and promotes granulation; used as a plaster it mitigates all kinds of inflammation.

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* Dios. iii., 90. περὶ σαρκοκόλλας.

† Plin. 13, 20; 24, 78.

Masíh adds that it is cathartic and useful for the expulsion of phlegm and corrupt humours. Haji Zein el Attar says that the Persian name is گوزد (gúzhad), and that the tree which produces it grows in the Shabánkárah hills near Shiraz. Another name for the gum is Jahudáneh. When it first exudes it is white, but from exposure to the sun it becomes red.

Amongst modern writers, Mir Muhammad Husain, the author of the Makhzan-el-Adwiya, informs us that Anzerút is at Ispahan called Kunjud and Agardhak, at Shiraz Kunderú; in Arabic it is known as Kohl-Fársi (Persian collyrium) and Kohl-Kirmáni (Kirman collyrium). The Indians call it Lai. He describes it as the gum of a thorny plant called Shayakah, which is about 6 feet high, has leaves like those of the Frankincense, and is a native of Persia and Turkistan; he then gives a correct description of the drug, and states that it is aperient, and a resolvent of corrupt and phlegmatic humours, &c.; it acts best when combined with such medicines as turpeth, myrobalans, sagapenum, &c. Speaking of particular diseases in which it is employed, he mentions its use in congestive apoplexy combined with castor-oil, and topically in purulent discharges from the eyes;* roasted with onions it is dropped into the ear to cure earache. It is also used internally as an antirheumatic and anthelmintic. The Egyptian women eat it on account of its fattening properties. Dose, ½ to 2 miskáls; large doses are said to prove fatal by obstructing the intestinal glands. With regard to its use in plasters his remarks are to the same purport as those of Ibn Sina. When used as a collyrium he directs it to be prepared by being beaten up in ass's milk, and afterwards dried in an oven until slightly baked.

European writers on Materia Medica briefly notice Sarcocolla. Guibourt remarks that if the statements of the Greeks and Arabians are correct, it cannot be the produce of a Penœa, a genus confined to Africa. He states that Pelletier found it to consist of Sarcocolline 65·30, gum 4·60, gelatinous matter

* In the Tibb-i Akbari the following receipt is given:—Starch 6 parts, Anzerút and white lead of each 2 parts; sift very fine for an eye-powder.

3·30, woody matter, &c., 26·80. Sarcocolline is described as a substance *sui generis*, soluble in 40 parts of cold water, and 25 parts boiling. A hot saturated solution precipitates on cooling, part of the sarcocolline, which separating as a syrupy liquid, is no longer soluble in water. Alcohol dissolves it in all proportions, the solution mixed with water becomes turbid, but does not precipitate.

Description.—Sarcocolla consists of more or less agglomerated very friable grains; it is opaque or semi-transparent, and varies in colour from deep red to yellowish white or grey; it has hardly any odour and a sharp bitter sweet taste; it swells when heated, and burns with an odour of burnt sugar. Gum Sarcocolla is imported into Bombay from the Persian port of Bushire in bags which contain about 2 cwts.; the total quantity imported must be considerable, as from 12 to 20 bags may often be seen in a single warehouse. The original packages always contain portions of the plant, of which the following is a description:—

Fruit.—Peduncles short, slender; calyx oblong, bell-shaped, chaffy, ¾ in. long, with a 5-dentate narrow, open mouth, within it are the dry petals, and an oblong, silicious, rostrated pod, as large as a grain of rice in the husk, and having its external surface thickly covered with a felting of white, cotton-like down, consisting of long simple hairs matted together. Although the pod is mature, the petals remain firmly attached, the upper one is hooded and envelopes the rostrum of the pod. The pod is two-valved; attached to its dorsal suture on one side is a single, greyish-brown, vetch-like seed, having a diameter of ⅛ inch; when soaked in water it swells, bursts, and a mass of Sarcocolla protrudes; some of the pods are abortive and are full of the gum.

Stem.—Woody, composed of numerous radiating, wedge-shaped bundles, thorny; thorns ¾ to 1 inch long, and together with the young branches more or less covered with cotton-like down, and encrusted with Sarcocolla.

No leaves were found, but native authors describe them as similar to those of the Frankincense.

Several handfuls of the fruit may be picked from a bale of gum, but most of it has lost its chaffy calyx from friction. As leaves are never seen, it is probable that the Sarcocolla is collected by beating the bushes after the leaves have fallen. The exudation must be so abundant as to flow on the ground, as masses of sand, glued together by it, of large size, are found in the packages.

Commerce.—The average value of Sarcocolla is Rs. 3 per maund of 37½ lbs. It is rather an important medicinal article in India, as it is one of the principal ingredients of the *lép* (plaster), which the Parsee bone-setters use in combination with cotton to form a support to fractures or sprains, and also to weak joints. The usual composition of *Lép* is Sarcocolla 9 parts, Jadvar 1, Socotrine Aloes 16, Alum 8, Maida-lakri 4, Singapore Dammer 4, Frankincense 7, Ambehalad 7, and Gamboge 12 parts. These ingredients are reduced to a fine powder and then rubbed into a paste with water by means of a stone and muller.*

ASTRAGALUS HERATENSIS, *Bunge.*

Fig.—*Trans. Lin. Soc. 2nd. Ser. Botany. Vol. iii. Pt. I., Plate vi.*

Vernacular—Gabina (*Pers.*). The gum, Katira.

ASTRAGALUS, sp. *aff. A. strobilifero,* Royle.

Hab.—Persia.

Vernacular.—Kon (*Pers.*). The gum, Katira.

History, Uses, &c.—Western Persia has long been known to export to India a gum called *Katira,* similar to the

* Compare with the malagmata of the Greeks and Romans. Scrib. Comp. 258, *et seq.*

Tragacanth of Western commerce. Tragacanth has been known from a very early period, and Theophrastus and Dioscorides were probably familiar with the plant from which it was obtained, as the latter writer describes it very correctly. The later Greek physicians were all acquainted with the drug, as well as Masih, Ibn Sina, and the other Arabian writers. Haji Zein, A. D. 1368, describes its uses almost in the words of Dioscorides; he calls it Katira, the gum of the tree called Katád; this name the Arabs have converted into Kathirá. According to the Persian Burhán, the Arabic name for the tree is Miswák-el-Abbas. The author of the "Makhzan-el-Adwiya" says that the Persian name of the tree is كون (Kon), a name which Dr. Aitchison found to be current among the peasantry of the Hari-rud valley for the second species placed at the head of this article. Formerly the imports of Tragacanth into India were insignificant, and only sufficient to meet the requirements of a few Persian physicians practising in the country, with whom it is a favourite pectoral, and demulcent in urinary affections. Now, however, it is making its appearance in the Bombay market in large quantities, and of a superior quality to that formerly imported, for the purpose of export to Europe. In modern medicine Tragacanth is chiefly valued for its mechanical property of suspending insoluble powders in mixtures and for giving firmness to lozenges and pill masses.

Secretion.—It has been shown by H. von Mohl and by Wigand that Tragacanth is produced by metamorphosis of the cell membrane, and that it is not simply the dried juice of the plant. The stem of a gum-bearing *Astragalus*, cut transversely, exhibits concentric annual layers which are extremely tough and fibrous, easily tearing lengthwise into thin filaments. These inclose a central column, radiating from which are numerous medullary rays, both of very singular structure, for instead of presenting a thin-walled parenchyme, they appear to the naked eye as a hard translucent gum-like mass, becoming gelatinous in water. Examined microscopically, this gummy substance is seen to consist not of dried mucilage, but

of the cells of the pith and medullary rays in process of transformation into Tragacanth. The transformed cells, if their transformation has not advanced too far, exhibit the angular form and close packing of parenchyme-cells, but their walls are much thickened, and evidently consist of numerous very thin strata. A similar mode of gum formation from cellulose may be observed in the bark of *Kydia calycina* (*see* p. 228), and a less complete transformation of the same kind in the exudation from the stem of *Bombax malabaricum* (*see* p. 217).

Description.—Tragacanth consists of different layers, either laid one upon another and spirally twisted, or confluent into tear-like masses, or extended into curved, narrow, or broad bands, varying in width between ¼ inch and 1 inch, and sometimes 4 or 5 inches long. These bands are rarely made up of a single layer, but usually are marked with several parallel ridges, indicating the various strata, which are united into broader and thicker laminæ. This form of tragacanth is known as *flake tragacanth* or *leaf gum*, and is the more valuable the whiter and more translucent it is. Smyrna tragacanth is mostly in rather broad and thick flakes, which are yellowish or of a brownish tint, and often prominently ridged. Thin, ribbon-like, and white flakes are produced in Kurdistan and Persia, but are sometimes distinguished in commerce as Syrian tragacanth. Another variety is *vermiform tragacanth,* also called *vermicelli.* It consists of very narrow, variously coiled and contorted string-like pieces, the different coils of which are most frequently confluent. *Common tragacanth,* or *sorts,* in Europe known as *traganton,* is the product obtained by spontaneous exudation, forming sub-globular, conical, or variously shaped tear-like pieces, with the surface rounded and more or less irregular, and usually of a brownish or brown colour, and rather waxy in appearance; but it shows the stratification described above, and, like the white and thin bands, enclose starch.

Tragacanth is hard, tough, difficult to powder, inodorous, and tasteless, insoluble in alcohol and ether, and forms with 50

parts of water a thick, jelly-like mucilage. When diffused in a much larger quantity of water it forms a ropy liquid which may be passed through a filter, leaving behind an insoluble residue, which in contact with iodine acquires a blue colour from the presence of starch. The mucilage acquires a yellow colour on the addition of caustic soda, and the solution of tragacanth yields clear mixtures with borax, ferric chloride, and sodium silicate, is precipitated by alcohol, thickened by cold lead acetate and subacetate, and precipitated by these salts on heating. (*Flückiger.*)

Chemical composition.—Tragacanth has a specific gravity of 1·38, and contains two gums, one insoluble and the other soluble in water, about 14 per cent. of moisture and 3 per cent., or less, of ash. A reaction for starch is obtained in most samples, and a peculiar red-colouring matter has been observed in some specimens from Persia. The insoluble gum has been named *Bassorin*, $C^{12} H^{20} O^{10}$, an isomer of starch, which forms a sugar when boiled with diluted acid, and mucic acid when heated with nitric acid. The soluble gum affords no precipitate or jelly with alkaline borates, silicates or stannates or ferric chloride, and its solution is rendered turbid by plumbic acetate, and throws up a transparent jelly with alcohol, all of which reactions point to the gum being different to arabin. Giraud considers the insoluble portion of tragacanth to be a pectic compound, and the soluble portion to be a mixture of different bodies, not a definite principle like arabin. Bassorin is an unsaturated compound, whereas arabin and the soluble gums are usually associated with lime or potash. The proportion of soluble gum has been variously estimated at from 5·6 to 50 per cent., but these results are attendant upon the employment of small or large quantities of water, and the period of immersion.

In Northern India the seeds of **Astragalus multiceps**, *Wall.*, and **A. tribuloides**, *Delille*, are used on account of their demulcent properties.

LUPINUS ALBUS, *Linn.*

White Lupine (*Eng.*), Lupin blanc (*Fr.*).

Hab.—Egypt, Levant.

Vernacular.—Turmus, Bákila-i-misri (*Arab., Pers., Ind.*).

History, Uses, &c.—This plant has been cultivated since the days of the ancient Egyptians, and is still very extensively sown in Italy, Sicily, and other Mediterranean countries for forage, for ploughing in to enrich the land, and for its round flat seeds, white outside but yellow internally, which when boiled, so as to remove the bitter somewhat deleterious principle, form an important article of food in some districts. It is the θερμος of the Greeks,* and was much esteemed by the ancients for its medicinal properties. Pliny (22, 74), following the Greeks, informs us that dried lupines stripped of the husk and pounded are applied in a linen cloth to black ulcers, in which they make new flesh: boiled in vinegar they disperse scrofulous sores and imposthumes of the parotid glands. A decoction of them with rue and pepper is given in fever and to expel intestinal worms. He also states that lupines stimulate the appetite and dispel nausea, and that the meal kneaded with vinegar removes pimples and prurigo and allays inflammations. A decoction of them is very good for affections of the spleen, and with honey for retardations of the catamenia: a decoction of the root acts as a diuretic. The Indian Mahometan physicians follow the ancients, but they especially esteem lupines for their supposed pectoral and strengthening properties. In European medicine lupines are no longer used, but the flour was formerly one of the *quatre farines résolutives.* Donnabella (*Practitioner*, xxi., 211, 1877) reported that, having thrown into the rectum about five ounces of a decoction of lupines he soon began to feel general malaise, uneasiness of the head, obscuration of vision, heaviness of the eyelids, vertigo, excitement of mind

* Throphr. H. P. I, 6, 12; III, 3; VIII, 1, 2, 7, 10, and C. P. III, 4. Dios. II, 101.

and a sense of constriction of the larynx and pharynx. Several months afterwards he repeated the experiment with the same results. The poisonous principles of lupines, *Ictrogen* and *Lupinotoxin,* are only developed under certain conditions and lose their poisonous properties when heated with water under pressure.

Description.—*L. albus* is an annual plant with palmately 5 to 7-foliate leaves, and obovate-oblong leaflets 1 to 2 inches in length, smooth above and tomentose beneath; the flowers are in terminal racemes on short pedicels, white and rather large; the legume is 3 to 4 inches long, flattish, and contains 3 to 6 depressed globular seeds having a bitter taste.

Chemical composition.—Baumert (*Ann. Agron. April* 25, 1889), who has made a fresh examination of the seeds of the white lupine, found the watery extract to be strongly acid, and to contain malic, oxalic and citric acids. The seeds yielded to ether about 5 per cent. of a golden-yellow oil, free from bitterness, and also a wax soluble in boiling alcohol first noticed by Boyer; these two fatty substances contain phosphorus. Lupines contain no starch or inulin, but a peculiar substance related to dextrine, strongly dextrogyre, and yielding with dilute mineral acids a reducing sugar. This body lately isolated by Steiger is a white hygroscopic powder soluble in water, hardly soluble in alcohol, insoluble in ether; it has been named *galactane,* and may be regarded as a form β of *galactine,* which Müntz obtained from *lucerne.* The seeds also contain another carbo-hydrate discovered by Schulze and Steiger which is insoluble in water, and which when boiled with acids is converted into galactose; it has been named *paragalastine.*

The albuminous portion of the seeds consists chiefly of conglutin with a small proportion of legumin and vegetable albumin. The following table from König's *Nahrungs-mittel* gives the average percentage composition of fourteen samples of yellow lupine seeds:—

Water	12·88
Nitrogenous matter	36·52

Fat	4·92
Nitrogen free extractive	27·60
Cellulose	14·04
Ash	4·04
In dry substance.	
Nitrogen	6·71
Carbo-hydrates	31·68

Three alkaloids have been separated from the different kinds of lupine seed, *luzinine,* $C^{21}H^{40}N^{2}O^{2}$, which is crystallizable, *luzanine* $C^{15}H^{25}N^{2}O$, and *lupulidine,* $C^{8}H^{15}N$, a liquid. According to Paulus and Hiller the total quantity of alkaloids found in different kinds of seed ranges from 0·04 to 0·81 per cent.; yellow lupines contain from 0·65 to 0·81 per cent. of luzinine and lupulidine.

Hayen found in blue lupines only luzanine. Lupine seeds contain only traces of amides or acid amides, none of which have been isolated, but when the seeds are allowed to germinate, a number of these bodies, *viz.,* asparagin, phenyl-amido-propionic acid, amido-valerianic acid, leucine, tyrosin, zanthine, hypozanthine, lecithine, peptone, arginine ($C^{6}H^{14}N^{4}O^{2}$), and choline, make their appearance. Lupinin, $C^{29}H^{32}O^{16}$, the glucoside of lupines, was discovered by Schulze and Barbieri; it crystallizes in fine needles, and dissolves in alkaline solutions communicating to them a yellow colour, with acids it breaks up into lupigenin ($C^{17}H^{12}O^{10}$) and glucose.

MM. Campini and Grimaldi (*Chem. Repert.* 1888, 76,) report that they have isolated *vanillin* from the seeds of *Lupinus albus,* and proved its identity by the crystalline form and by its chemical properties.

Vicia Faba, *Linn.*—The field bean (*Eng.*), Fève des champs (*Fr.*), Bakila (*Pers., Ind.*), is a native of Persia, but now universally cultivated. For an interesting account of the mythology of the bean and its phallic properties, see De Gubernatis. (*Myth. des Plantes ii*, 132—137.) Pliny mentions their use as a food and as a medicine (18, 30; 22, 69).

The hakíms administer them as a nutritive tonic for rendering the body fruitful (تخصیب البدن); and consider them to be deobstruent and expectorant; the roots are said to be diuretic. The author of the Makhzan, speaking of Bákila, gives κύαμος and several other synonyms for them, and fully describes the various uses to which they are put.

They must not be confounded with the κύαμος αιγυπτίος or Coptic bean, the seed of *Nelumbium speciosum.*

Beans are rich in proteids and phosphoric acid, but contain only a small percentage of amylaceous and saccharine matter. The following table showing the percentage composition of beans is taken from König's *Nahrungs-mittel*, and is a summary of the results of 41 analyses of different cultivated varieties of *Vicia Faba*:—

	Maximum.	Minimum.	Mean.
Water	19·70	10·80	14·76
Nitrogenous matter	29·86	17·41	24·27
Fat	2·66	1·12	1·61
Nitrogen free extractive	53·40	44·39	49·01
Cellulose................	11·30	3·26	7·09
Ash	4·72	1·72	3·26
In dry substance.			
Nitrogen	5·37	3·27	4·56
Carbo-hydrates	62·65	52·08	57·48

CICER ARIETINUM, *Linn.*

Fig.—*Wight Ic.*, *t.* 20; *Bot. Mag.*, *t.* 2274. Common Chickpea (*Eng.*), Chiche, Tête de belier (*Fr.*).

Hab.—Unknown. Cultivated in warm climates. The seeds and acid exudation.

Vernacular.—Chana (*Hind.*, *Guz.*), Harbàra, Chana (*Mar.*), But (*Beng.*), Kadalai (*Tam*), Kadali (*Can.*).

The acid exudation, Chane-ka-sirka (*Hind.*), Chana-amba (*Mar.*), Kadalai-kádi (*Tam.*), Chana-no-khàto (*Guz.*).

History, Uses, &c.—This pulse is the Cicer of the Romans.* Plautus† and Horace‡ speak of 'Cicer frictum,' 'parched gram,' which would appear to have been eaten by the poorer classes just as it is in India now. The Italians call it 'Cece.' The plant is cultivated in the south of Europe and also in India, the leaves and stems are covered with glandular hairs containing oxalic acid, which exudes from them in hot weather and hangs in drops, ultimately forming crystals. In India the seeds form one of the favourite pulses of the natives, being eaten raw or cooked in a variety of ways; the flour is also much used as a cosmetic and in cookery. Cicer is the ερεβινθος of Dioscorides. The acid liquid, which is obtained by collecting the dew from the Chanaka plant, is mentioned in Sanskrit works under the name of Chanakámla, and is described as a kind of vinegar having acid and astringent properties, which is useful in dyspepsia, indigestion, and costiveness. Moidín Sheriff gives the following description of its collection:—"In a great many parts of India, where *C. arietinum* is cultivated, a piece of thin and clean cloth is tied to the end of a stick, and the plants are brushed with it early in the morning, so as to absorb the dew, which is then wrung out into a vessel."

Dr. Hové (1787) says:—"On the road (to Dholka) we met with numerous women who gathered the dew of the grain, called by the inhabitants *chana*, by spreading white calico cloths over the plant, which was about 2 feet high, and then drained it out into small hand jars. They told me that in a short period it becomes an acid, which they use instead of vinegar, and that it makes a pleasant beverage in the hot season when mixed with water." Dr. Hové states that the freshly collected fluid tasted like soft water, but that some which he preserved became after some days strongly acid.

According to Dr. Walker (*Bomb. Med. Phys. Trans.*, 1840, p. 67), the fresh plant put into hot water is used by the Portuguese in the Deccan in the treatment of dysmenorrhœa; the patient sits over the steam. He remarks this is only another

* Col., 2, 10; Plin. 22, 72. † Plant Bac., 4, 5, 7. ‡ A. P., 249.

way of steaming with vinegar. Notices of the acid liquid, its uses by the natives, and mode of collection, are given by Dr. Christie (*Madras Lit. Sci. Journ.*, Vol. IV., p. 476); Dr. Heyne (*Tracts*, p. 28); Ainslie (*Mat. Ind.*, Vol. II., p. 56).

Chemical composition.—The fluid collected from the plant consists of water holding in solution oxalic, acetic, and perhaps malic acid, and, according to Dispan, another acid peculiar to the plant. (*Watts' Dict. of Chem. I., p.* 962.) The husked seeds have been examined by Church, who found them to contain:—Water 11·5, Albuminoids 21·7, Starch 59·0, Oil 4·2, Fibre 1·0, Ash 2·6, Phosphoric acid 1·1 per cent. (*Food Grains of India.*) In Lyon's Food Tables, the nitrogen per ounce is given at 14·00 grains. (*Food Tables, Bombay,* 1877.)

The other pulses mentioned by Sanskrit medical writers are:—

Mudga (*Phaseolus Mungo, Linn.*), Mung (*Hind., Beng., Mar., Guz.*), Puchapayaru (*Tam.*), Pessalu (*Tel.*). Of this pulse two varieties are distinguished by the Hindus, one green, the other yellow. For medicinal purposes the first is preferred. According to Church, the chemical composition of these pulses with their husks is:—*Green:* Water 10·8, Albuminoids 22·2, Starch 54·1, Oil 2·7, Fibre 5·8, Ash 4·4. *Yellow:* Water 11·4, Albuminoids 23·8, Starch 54·8, Oil 2·0, Fibre 4·2, Ash 3·8, Phosphoric acid about 1 per cent.

Masha (*Phaseolus, Mungo, Linn.* var. *radiatus*) Másh, Urid (*Hind., Beng., Mar., Guz.*), Mimumuli (*Tam.*). *Chemical composition.*—Water 10·1, Albuminoids 22·7, Starch 55·8, Oil 2·2, Fibre 4·8, Ash 4·4, Phosphoric acid 1·1 per cent. (*Church.*)

Mudgaparni (*Phaseolus trilobus, Ait.*), Mugani (*Hind. Beng.*), Muknya, Arkmut (*Mar.*) Nitrogen per oz. 19·78 grains. (*Lyon.*)

Makushtha (*Phaseolus aconitifolius, Jacq.*), Moth (*Hind., Beng.*), Math (*Mar.*) *Chemical composition.*—Water 11·2, Albuminoids 23·8, Starch, 56·6, Oil 0·6, Fibre 4·2, Ash 3·6, Phosphoric acid ·8 per cent. (*Church.*)

Kulattha—(*Dolichos biflorus, Linn.*), Kulthi (*Hind., Beng., Mar.*), Kollu (*Tam.*), Wulawalli (*Tel.*). *Chemical composition with husk*—Water 11·0, Albuminoids 22·5, Starch 56·0, Oil 1·9, Fibre 5·4, Ash 3·2, Phosphoric acid 1·0 per cent. (*Church.*)

Rajamaha. (*Vigna Catiang, Endl.*), Choulai (*Hind., Mar.*), Barbati (*Beng.*), Boberlu (*Tel.*). *Chemical composition, Husked*—Water 12·5, Albuminoids 24·1, Starch 56·8, Oil 1·3, Fibre 1·8, Ash 3·5, Phosphoric acid 1·0. (*Church.*) *With husk*—Water 12·7, Albuminoids 23·1, Starch 55·3, Oil 1·1, Fibre 4·2, Ash 3·6, Phosphoric acid 1·2. (*Church.*)

Masura (*Ervum Lens, Linn.*), Masur (*Hind., Beng., Mar.*), Misurpurpur (*Tam.*), Misurpappu (*Tel.*). *Chemical composition, Husked*—Water 11·8, Albuminoids 25·1, Starch 58·4, Oil 1·3, Fibre 1·2, Ash 2·2, Phosphoric acid ·8 per cent. (*Church.*)

Satila (*Pisum sativum, Linn.*), Matar (*Hind., Beng.*), Watana (*Mar.*). Nitrogen, per oz., 17·09 grains (*Forbes Watson*), about the average of all the pulses.

Adhaki (*Cajanus indicus, Spreng.*), Tur, Arhar (*Hind., Mar.*), Arar (*Beng.*). *Chemical composition, with husk*—Water 13·3, Albuminoids 17·1, Starch 55·7, Oil 2·6, Fibre 7·5, Ash 3·8, Phosphoric acid ·9 per cent. (*Church.*)

Simbi (*Dolichos Lablab, Linn.*) Sim, (*Hind., Beng.*), Walpapri (*Mar.*), Avri (*Guz.*), Alsànda (*Tel.*). *Chemical composition, with husk*—Water 14·6, Albuminoids 20·5, Starch 53·5, Oil 2·2, Fibre 5·8, Ash 3·7. (*Church.*)

Triputi (*Lathyrus sativus, Linn.*), Khesari (*Hind., Beng.*), Lang (*Guz., Mar.*). *Chemical composition*—Water 10·1, Albuminoids 31·9, Starch 53·9, Oil ·9, Ash 3·2. (*Church.*) The toxic principle obtained from this pulse by Astier, was a volatile liquid alkaloid, probably produced by some proteid ferment whose action is destroyed by heat.

Remarks.—Some of these pulses have several varieties produced by cultivation. Green mudgá is considered wholesome and suited to sick persons; a soup of it is often the first article of diet after recovery from acute illness. The following are considered wholesome and suited for use by convalescents: Masura, Kulattha and Makushtha. Masura is considered as highly nutritive and useful in bowel complaints; a poultice of it made with vinegar is an effectual domestic remedy for checking the secretion of milk, and reducing swellings of the mammary glands caused by their distension with milk. Másha and Kulattha are considered to have the latter property. A soup made with Kulattha is prescribed as an antilithic. Másha is much used in medicine, internally and externally, in paralysis, rheumatism and nervous affections; but it is always combined, with other drugs, such as asafœtida, Ricinus root, Mucuna Sida, &c. (*Dutt.*) Mash, Kalie and Masur are not allowed to be eaten by Hindu widows, as these varieties are supposed to be too stimulating.

Lathyrus sativus, as article of diet, has long been known to be capable of producing toxic symptoms when used for a prolonged period either by animals or human beings. In one district in Bengal, nearly four per cent. of the population were sufferers from it in 1860. (*Irving, Indian Ann. of Med. Sci., vii.,* 127; *Kirk, ibid.,* 145.) This condition, known as *lathyrismus,* has been investigated by Dr. B. Suchard. The chief effect produced on the human subject is upon the muscles of the lower extremities, especially on those below the knee. In horses also paralysis of the hinder extremities takes place, and death has followed from bilateral paralysis of the laryngeal recurrent nerves and consequent asphyxia. The laryngeal affection has not, however, been observed in the human subject. Cantarri of Naples has recorded a number of cases in which he has carefully examined the muscles, and has found that the adductors are less effected than the abductors. The muscle of the face, neck, and trunk were not affected. Cutaneous sensibility is not always affected, even in the legs; reflex action is

unaffected. The descending galvanic current produces slight contractions, but only when the current is closed. These contractions are weaker on the right side than on the left, and weaker in the flexors than in the extensors; with the ascending current no contractions are obtained, whether the current is open or closed. Examined under the microscope the affected muscles showed a diminution in the number of transverse striæ, and little globules of oil were observed. The *post-mortem* examinations failed to show any lesion of the spinal cord.

Teramnus labialis.—*Spreng.*, *Wight, Ic. t.* 168. This wild pulse is called in Sanskrit Másha-parni, "having leaves like Másha" (*Phaseolus Roxburghii*), Haya-puchchha "horse's tail," and Svayambhu, "self-existing." It is described in the Nighantas as cooling, pungent, dry, strengthening, sweet, astringent, digestive and febrifuge. In the vernaculars it bears the following names:—Máshparni (*Hind.*), Masháni (*Beng.*), Adavi-vuddulu (*Tel.*), Káttu-alandu (*Tam.*), Káda-uddhu (*Can.*), Rán-udid (*Mar.*). Like Másha it is much used in medicine both internally and externally in paralysis, rheumatism and affections of the nervous system. (*See Másha.*)

GLYCYRRHIZA GLABRA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 74. Liquorice (*Eng.*), Réglisse (*Fr.*).

Hab.—Europe, Northern Asia. The root and extract.

Vernacular.—Jethi-madh, Mulatthi, Mithi-lakri (*Hind.*), Jethi-madh (*Guz.*), Jeshti-madh (*Mar.*), Ati-maduram (*Tam.*), Yashti-madhukam (*Tel.*), Yashti-madhuka (*Can.*), Jaishto-modhu (*Beng.*).

History, Uses, &c.—Liquorice grows wild in Arabia, Persia, Turkistan and Afghanistan, and has been introduced into the Punjab and Sind. Kinneir observed it growing abundantly near Basra, and Aitchison found it growing abundantly

all over the Badghis and throughout the Harirud and Khorasan districts. In Persia glass-bottle-makers use the wood for melting their materials, as they say it gives a greater heat than any other kind of fuel. The root, in Sanskrit called Yashtimadhu and Madhuka, must have been known to the Hindus from a very early date, as it is mentioned by Susruta. Hindu works describe it as demulcent, cooling and useful in cough, hoarseness, &c. It is also recommended as a flavouring agent, and enters into the composition of many external cooling applications.

Abu Hanifeh describes *Sus* as a well-known plant, the expressed juice of which is an ingredient in medicine. He says the roots are sweet and the branches bitter. El Mutarrizi in the Mughrib states that the leaves are put into the beverage called *nabid* to make it strong. The modern Arabs call the root Irk-es-sus, and make a strong infusion of it which they drink. The dried juice is called Rab-es-sus; it is made by the Arabs, Turkomans, and Persians at Yezd. In Persia the liquorice plant is called Mehak and Mazhu.

The author of the *Makhzan-el-Adwiya* gives a lengthy description of the plant, and directs the root to be decorticated before it is used. He says that the Egyptian is the best, next that of Irak, and then Syrian. The root is considered hot, dry and suppurative, demulcent and lenitive, relieving thirst and cough, and removing unhealthy humours, also diuretic and emmenagogue, useful in asthma and irritable conditions of the bronchial passages. Ibn Sina recommends the decoction in cold colic; it is also dropped into the eyes to strengthen the sight.* A poultice made of the leaves is said to be a cure for scald head, and stinking of the feet or arm pits. Muhammad bin Ahmad and Yohanna bin Serapion recommend the seeds as being the most active part of the plant.

For an account of the history and cultivation of liquorice in Europe, the *Pharmacographia* may be consulted.

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* Conf. Dios. *περί γλυκύῤῥιζης* iii., 5; and Plin. 22, 11; Celsus 5, 23, calls it Dulcis radix.

Description.—Liquorice root varies much in size, the largest pieces being 2 inches or more in diameter, and about 4 or 5 inches long, with the bark on; the wood is of a bright yellow colour, tough and fibrous. The taste is sweet at first, afterwards a little bitter. The root is heavy and sinks in water.

Microscopic structure.—Commencing from the exterior the bark shows from 8 to 10 rows of closely packed brown tabular cells, then a cellular zone loaded with starch, next we meet with the expanded ends of the medullary rays, which gradually become narrower towards the woody part of the root, between them are pyramidal bundles made up of a parenchyme consisting of transverse cells and small bundles of liber cells with thick walls. The wood is traversed by large medullary rays continuous with and having the same structure as those in the bark. The woody columns are made up of large fenestrated vessels and bundles of wood cells, between which portions of parenchyme continuous with that of the medullary rays here and there intrude.

Chemical composition.—According to Flückiger and Hanbury (*Pharmacographia*, p. 158), liquorice root contains in addition to sugar and albuminous matter, a peculiar sweet substance named glycyrrhizin, which is precipitated from a strong decoction upon addition of an acid or solution of cream of tartar, or neutral, or basic acetate of lead. When washed with dilute alcohol and dried, it is an amorphous yellow powder, having a strong bitter-sweet taste and an acid reaction. It forms with hot water a solution which gelatinizes on cooling, does not reduce alkaline tartrate of copper, is not fermentable, and does not rotate the plane of polarization. From the analysis and experiments of Gorup-Besanez (1861), it appears that the most probable formula of glycyrrhizin is $C^{24}H^{36}O^{9}$. By boiling glycyrrhizin with dilute hydrochloric acid, it is resolved into a resinous amorphous bitter substance named glycyrretin, and an uncrystallizable sugar having the characters of glucose. The formula of glycyrretin has not yet been

settled. Alkalies easily dissolve glycyrrhizin with a brown colour and emission of a peculiar odour. In the root it perhaps exists combined with ammonia, inasmuch as the aqueous extract evolves that alkali when warmed with potash. The sugar of liquorice root has not yet been isolated. Asparagin and malic acid have been obtained from it. The outer bark contains a small quantity of tannin.

The sweet taste of the roots is probably owing to the glucoside combined with ammonia. Habermann found that glycyrrhizin-ammonia was the acid ammonium salt of a nitrogenous body, glycyrrhizic acid, and this acid he considers to be the active principle of liquorice. It forms a jelly-like mixture with 100 parts of water, and is insoluble in ether and slightly soluble in alcohol. Glycyrrhizic acid breaks up on boiling with dilute sulphuric acid into glycyrrhetin and parasaccharic acid. (*Ann. Chem und Pharm.*, 197, p. 105.)

Commerce.—The Indian market is supplied from Persia, the Punjab and Sind. The kind known as Karachí liquorice is the best, and fetches from Rs. 50 to 80 per kandy of 5 cwts. Persian liquorice is smaller, and not so sweet.

ARACHIS HYPOGÆA, *Linn.*

Fig.—*Bentl. and Trim., t.* 75. Ground-nut, Peanut, Monkey nut (*Eng.*), Pistache de terre (*Fr.*).

Hab.—Africa, cultivated in India. The seeds and oil.

Vernacular.—Beláti-mung, Chini-bádám (*Hind., Beng.*), Bhuisingh (*Mar.*), Verk-kadalai, Nilak-kadalai (*Tam.*), Veru-shanaga-kaya (*Tel.*), Nelagale-kayi, Nelakadali (*Can.*), Bhui-chana (*Guz.*).

History, Uses, &c.—The ground-nut, a native of Africa, is not mentioned in Hindu or Mahometan works on Materia Medica, nor does it appear to be used in India by the natives for any medicinal purpose. The seeds, however, are eaten like nuts and are pressed for their oil. As far as we

can gather, the ground-nut does not appear to have been cultivated extensively in India for more than about fifty years. It was probably introduced into Bengal from China, as it was first known in that part of the country as Chini-bádám (Chinese almond). In Western India it was most likely introduced from Africa, or possibly by the Portuguese from Brazil, and was no doubt used only as an article of diet for a considerable time, just as the seeds of a closely allied plant (*Voandzeia subterranea*) imported from Mozambique are at present eaten in Goa and Bombay under the name of Mosambi-chana (Mozambique gram). The value of the ground-nut as an oil seed was first recognised in Europe about 1840, since which date its cultivation has been greatly extended. At the present time the seeds and oil are largely exported to Europe, where the latter is much used for soap-making. In Bombay the oil is expressed at the Government Medical Store Depôt for pharmaceutical purposes to the extent of about 6,000 lbs. annually. It is used as a substitute for olive oil. For making plasters the mixed sweet oil of the bazar may be used, but it requires rather more oxide of lead than ground-nut oil, the latter in the proportion of 90 lbs. of oil to 41 lbs. of oxide makes an excellent plaster of a very pale colour and perfect consistence. Ninety pounds of bazar oil require 43 lbs. of oxide.

Description.—Cold drawn ground-nut oil is of a pale yellow colour, and has an agreeable nutty odour and bland taste; it is a non-drying oil, the yield from the nuts being about 38 to 45 per cent. The specific gravity of the fresh oil is ·918 at 15° C. and of the old ·920. At 3° C. it becomes turbid, at 3° to 4° it concretes, and hardens at —7°. If kept long it becomes rancid. (*Brannt.*)

Chemical composition.—In Arachis oil, the commoner glycerides, palmatin and olein are partially replaced by the homologous glycerides of hypogæic and arachidic acids. (*Allen.*) A glyceryl ether of Arachic acid also occurs in the tallow of *Nephelium lappaceum.* (*Oudeman.*)

Kreiling, besides separating arachic acid, obtained another acid which he identifies with lignocerinic acid, $C^{24}H^{48}O^{2}$, discovered by Hell and Hermann in 1880 in beechwood tar. (*Ber.* xxi., 880.) The seeds, according to Corenwinder, contain in 100 parts 6·76 water, 51·75 oil, 21·80 nitrogenous substances, 17·66 starch with some nitrogenous matter, 2·03 phosphoric acid, potash, magnesia and chlorine. (*Jour. de Phar. et de Chim.* 1875., XVIII.)

Commerce.—The plant is cultivated in many parts of Western and Southern India. The fluctuations in the quantity exported and in the price of the seeds indicate that the crop is an uncertain one and liable to partial failure from the attacks of insects or from an insufficient rainy season. In the Bombay market the price of the seeds ranges from Rs. 25 to Rs. 30 per kandy (5 cwts.) according as the supply is abundant or otherwise. There are two varieties, a light-coloured seed which is perferred for eating but does not yield much oil, and a reddish seed which yields much oil. During late years there has been a rapid increase in the quantity of ground-nuts exported from Bombay to Europe; in 1879-80, the exports were valued at two lakhs of Rupees, in 1880-81 eight and one quarter lakhs, in 1881-82 sixteen lakhs, of which latter quantity France alone took 12¾ lakhs, of the remainder Belgium took 2 lakhs worth, Germany Rs. 2,760, Holland Rs. 17,633, Italy Rs. 6,000, and England Rs. 1,381. In 1885-86, India exported 33,000 tons valued at 33 lakhs of rupees; in 1886-87, 47,000 tons valued at 42 lakhs; in 1887-88, 63,000 tons valued at 61 lakhs.

CÆSALPINIA BONDUCELLA, *Fleming.*

Fig.—*Gärt. Fruct. ii., t.* 148; *Bentl. and Trim., t.* 85. Nicker tree, Bonduc nut (*Eng.*), Yeux de bourrique (*Fr.*).

Hab.—India. The seeds.

Vernacular.—Katkaranj, Katkaleja, Ságarghola (*Hind.*), Kazhar-shikkay, Gech-chakkay (*Tam.*), Gach-chakaya (*Tel.*),

Gajaga-kayi (*Can.*), Jhagra-gula, Náta (*Beng.*), Kákachia, Gajga (*Guz.*), Gajri, Gajar-ghota (*Mar.*).

History, Uses, &c.—This plant, called in Sanskrit Pútikaranja, in Arabic Akitmakit, and bearing in Persia the vulgar name of Kháya-i-Iblis (Devil's testicles), has long been well known both to the Hindus and Mahometans as having medicinal properties; it appears to be found near the coast in all hot countries, its extensive distribution being caused by the transportation of its seeds from one country to another by means of oceanic currents. Ibn Sína says that its medicinal properties resemble those of the Peony. Clusius has a figure of the pods under the name of Lobus ἐχινώδης. Rumphius, who calls it *Frutex globulorum*, says that the seeds are vermifuge, and the leaves, roots and seeds emmenagogue, deobstruent and febrifuge. In Persia and India the seeds are considered to be hot and dry, useful for dispersing swellings, restraining hæmorrhage, and keeping off infectious diseases. Half a seed rubbed up with several cloves is said to relieve the pain of colic, and with long pepper to be a valuable remedy for malarious fevers. The seeds roasted and powdered are administered for hydrocele internally, and at the same time applied externally, spread upon castor-oil leaves. They are also given internally in leprosy, and are thought to be anthelmintic. The oil in which they have been boiled for a long time is applied to wounds to promote cicatrization. The oil expressed from the seeds is used as a cosmetic; it is said to soften the skin and remove pimples, &c. Necklaces of the seeds strung upon red silk are worn by pregnant women as a charm to prevent abortion, and are hung upon trees to prevent their fruit falling off. Ainslie notices the use of the seeds in conjunction with spice as a tonic by native practitioners, also their use as an external application to hydrocele. He besides draws attention to the root and leaves as having similar properties. In the Concan the juice of the leaves with yellow zedoary and *Butea frondosa* seeds is given to children for intestinal worms. Four tolás of the juice is given as an antiperiodic in fever, and

the seeds with gûr (molasses) in hysteria. In 1868 the seeds were made official in the *Pharmacopœia of India* as a tonic and antiperiodic, and in the compound powder (also official) the native form of administration with black pepper has been adopted. From the notes at the end of the *Pharmacopœia* it will be seen that the general tenor of the reports from medical officers in India is in favour of the antiperiodic and tonic effects of the remedy. The seeds are always kept in the druggists' shops, and are much used by native practitioners in the various ways above described. In Gambia, where they are called "Coorie seeds," the expressed oil is used for ear discharges, and a decoction of the roasted seed for consumption or asthma. The specific name of the plant is derived from the word Bunduk, an Arabic form of the Persian Finduk. The Arabs also call the seeds Hajar-el-ukáb, or "eagle stones."

Description.—The seeds are nearly globular, ½ to ¾ of an inch in diameter. They are of a dull grey colour, smooth, very hard: the umbilicus is surrounded by a small, dark brown, semilunar blotch opposite the micropyle; the shell is very thick, and contains a white kernel, which consists of two cotyledons and a thick radicle having a very bitter taste. The bark and wood of the root are hardly at all bitter. A microscopic examination shows the presence in the cotyledons of mucilage, starch, oil, and albumen. The cells of the testa are blackened by perchloride of iron, showing the presence of tannin.

Chemical composition.—The authors of the *Pharmacographia* isolated a non-alkaloidal bitter principle from the kernels. Recently (1886), MM. Ed. Heckel and Fr. Schlagdenhauffen found the cotyledons of the seeds to contain oil 25·130, bitter principle (resin?) 1·925, sugar 6·830, salts 3·791, albuminoid matter, soluble and insoluble, 20·490, starch 35·697, water 5·800, loss 0·327, per cent. The bitter principle of the Bonduc-nut is a white, bitter powder, without acridity; it is entirely soluble in alcohol, acetone, chloroform and glacial acetic acid; very little soluble in ether and bisulphide of

carbon, almost insoluble in petroleum ether and water. It is dissolved by essential and fatty oils, whence the bitterness of the oil extracted from the seeds by petroleum ether, a bitterness which can be removed by treating the oil with alcohol. The best method of preparing the bitter principle is to pour the chloroform solution into petroleum ether, or to precipitate with water a solution in glacial acetic acid. Alkalies have hardly any effect upon the bitter principle, ammonia dissolves a trace at the temperature of the water bath, caustic potash does not saponify it. Submitted to the action of heat it swells up and melts at 145° C., and then slowly decomposes; with hydrochloric acid it at first strikes a dark colour, then slowly dissolves, forming a rose-coloured solution. With nitric acid it is darkened, and finally separates into a number of red resinous drops; with sulphuric acid it forms a dark brown solution, which after half an hour becomes deep red; the red colour is much more marked when a trace of ferric chloride is added to the acid. The pure bitter principle yielded Messrs. Heckel and Schlagdenhauffen C 62·60, H 7·75, O 29·65 per cent., from which the formula $C^{14}H^{15}O^{5}$ is deduced. Clinical experiments made with this bitter principle by Dr. Isnard, Chief Medical Officer of the Customs Department, Marseilles, led him to the conclusion that in doses of from 10 to 20 centigrams it is as efficient a remedy in ordinary intermittents as quinine salts. (*Journ. de Phar. et de Chim., Aug. 1st,* 1886.) According to Brannt, the oil from the seeds is used as an embrocation in rheumatism.

Commerce.—The seeds are collected on the coast and sold to the druggists. Value, Rs. 12 per cwt.

Cæsalpinia digyna, *Rottl.*, a shrub of the E Himalayas, E. and W. Peninsulas and Ceylon, is used in native practice. The root (*Vákeri-mul*) is astringent. It is given internally in 6 massa doses mixed with milk, ghi, cummin and sugar, in phthisis and scrofulous affections; when sores exist it is applied externally as well; a kind of tuberous swelling which is found on the root is preferred.

CÆSALPINIA SAPPAN, *Linn.*

Fig.—*Roxb. Cor. Pl. i.* 17, *t.* 16. The wood. Sappan wood (*Eng.*), Sappan (*Fr.*).

Hab.—E. and W. Peninsulas, Pegu.

Vernacular.—Patang (*Hind., Mar.*), Vattangi, Vattekku, Vartangi (*Tam.*), Bokom (*Beng.*), Okánu-katta, Patanga-katta, Bukkapu-chekka (*Tel.*), Patanga-chekke (*Can.*), Patang (*Guz.*).

History, Uses, &c.—Sappanwood, in Sanskrit Pattanga and in Arabic and Persian Bakam, is by some Sanskrit authors included among the different kinds of Sandalwood in the same manner as the wood of *Pterocarpus Santalinus.* (*Vide P. Santalinus.*) It is cultivated in the Madras Presidency. When a daughter is born in a Thean family, the father plants a certain number of Sappan trees which form her dowry when married. Sappan wood is not generally used as a medicine either by Hindus or Mahometans, although it is described in their books as being of use to heal wounds and stop hæmorrhage from the lungs. Ainslie, however, says that the Vytians consider a decoction of the wood as a powerful emmenagogue, and remarks that the Cochin-Chinese hold the same opinion. In the *Bengal Dispensatory*, and more recently in the *Pharmacopœia of India*, it is recommended as a substitute for Logwood. At the Bombay Government Medical Depôt it has been used instead of Logwood for some years. Patang is used as a dye, and a very large quantity is consumed in the preparation of Gulál, the red powder which the Hindus cover themselves with at the time of the Holi festival. This powder is made by exhausting the wood with water, the liquid extract is then poured upon Tavákir (arrowroot of *Curcuma angustifolia*) and well mixed by treading it with the feet, alum is then added, and the mixture dried and powdered. Some makers also add a little carbonate of soda. Cheap aniline reds are however often now used instead.

Description.—The wood is solid, heavy, hard and close-grained, whitish when freshly cut, but becoming red from

exposure to the air. It has no particular taste or smell, but is astringent, and communicates a fine red colour to water and alcohol.

Chemical composition.—The colouring matter of Sappanwood appears from Bolley's investigations to be identical with Chevreul's brazillin obtained from brazilwood. Pure sappan red or brazillin, $C^{16}H^{14}O^{5}$, crystallizes from absolute alcohol in colourless rhombohedrons, or in short monoclinic prisms containing 67·11 per cent. of carbon, 5·43 hydrogen, and 27·46 oxygen; from hydrated alcohol or from aldehyde, in monoclinic needles, containing $2\ C^{16}H^{14}O^{5}3H^{2}O$, turning brown at 90° and giving off 6·61 per cent. of water; and no more at 120°. Brazillin resembles hematoxylin, and like it is soluble in ether, alcohol, and water. Alkalies produce a carmine-red coloration, which disappears when the liquid is warmed with zinc dust, but returns on exposure to the air. On boiling with peroxide of lead and water a strong fluorescence is developed. By oxidation brazilein is produced.

Commerce.—Two qualities are found in the market—*viz.*, Singapuri and Dhunsari, of about the same value, Rs. 42 per kandy of 7 cwts. A third quality from Ceylon is only valued at Rs. 30 per kandy.

The imports into Bombay in 1881-82 were 1887 cwts., valued at Rs. 11,816.

GOA POWDER.

Mr. D. S. Kemp (*Pharm. Journ.* (2), V., 345,) was the first to draw attention to this substance in 1864 as a secret remedy used by the native Christians of Portuguese India for a disease of the skin called *Gajkaran* in Marathi. It was then only occasionally offered for sale in Bombay at Rs. 12 to 30 for a tin containing 1 lb., and was known as *Ringworm Powder, Goa Powder*, or *Brazil Powder.* The exact date of its first introduction into India is not known, but like many other products of the New World, it was probably introduced by the

Jesuits towards the latter part of the 18th century. Kemp made an examination of it, and came to the conclusion that it contained principles similar to those described by Pelouze and Fremy as existing in Orchella weed. Attfield in 1875 (*Pharm. Journ.* (3), V., 721,) made a more complete examination, and obtained a substance (chrysarobin), which he supposed to be chiefly chrysophanic acid. In the same year Dr. J. F. Da Silva Lima of Brazil (*Med. Times and Gazette, Mar. 6th,*) suggested that the substance known as Goa Powder in India was probably identical with the Araroba or Arariba (tawny-coloured powder) of the natives of Brazil, called by the Portuguese *Po'de Bahia,* or Bahia powder, from its being obtained from that province. Dr. Da Silva Lima also stated that it was the produce of a leguminous tree, and had long been in use in the Brazils as a remedy for Herpes circinatus, chloasma and intertrigo. Shortly before this, Dr. Fayrer of Calcutta (*Med. Times and Gazette, Oct. 24th,* 1874,) had drawn the attention of the Medical profession to the value of Goa Powder made into a paste with vinegar or limejuice as a remedy for the skin diseases already mentioned, and his article appears to have attracted Dr. Da Silva Lima's attention to the subject. Mr. E. M. Holmes (*Pharm. Jour.* (3), V., 801,) stated that the wood found in Goa Powder was very similar to that of *Cæsalpinia echinata,* Lam., but J. L. Macmillan pointed out that this wood yields its colouring matter to water, while Araroba does not. In 1878, C. Liebermann and P. Seidler (*Pharm. Journ.* (3), IX., 896,) showed chrysarobin to be mainly a hitherto unknown compound, $C^{30}H^{26}O^{7}$, for which they retained the name proposed by Attfield.

The botanical source of Araroba was determined in 1879 (*Pharm. Journ.* (3), X., 42,) to be *Andira Araroba,* Aguiar, a large tree common in the damp forests of Bahia, where it is known as *Angelim amargoso.* The Araroba is contained in the large porous vessels and in clefts or cavities which traverse the wood in direction of the diameter, and are prolonged through the entire trunk; it is obtained by cutting down the tree, splitting the trunk, and scraping the powder from the clefts,

and is seen in commerce as a rough powder, or in small irregular pieces, originally of a light yellow colour, but usually darkened by exposure to light and moisture to a dull-ochrey, pale-brown, or even umber-brown or dark-purple colour. It has a bitter taste. (*Cf. Pharm. Journ.* (3), X., 814.)

Respecting the medicinal uses of Goa Powder, Sir J. Fayrer remarks:—"Europeans when in India, and occasionally after their return to Europe, are liable to certain troublesome eruptions on the skin of the trunk and extremities, which becoming chronic, are not only the source of considerable annoyance, but often somewhat tedious in yielding to treatment.

"One variety of the eruptions I refer to—commonly described as ringworm—assumes the form of reddish slightly raised spots, which rapidly spread as rings, encircling patches of sound skin, varying in size from a split-pea to that of a shilling, or even larger, with a slightly furfuraceous desquamation, and giving rise to much irritation and itching. They sometimes remain few and far between, but are apt to spread over all parts of the body or limbs.

"This eruption is due either to herpes or tinea circinatus, but probably, in many cases, to a combination of both of these; the initiatory patch of furfuraceous herpes becoming a congenial nidus for the subsequent development of the trichophyton of the tinea.

"Such, I would suggest, is the pathology of the eruption generally seen and spoken of as ringworm in India, though it is probable that other forms of eruptions, such as lichen circumscriptus, erythema, and psoriasis guttata, are at times included under the same designation. Another form of eruption to which I would allude is probably rather to be referred to chloasma. It affects the groins, the inner sides of the thighs, and those delicate surfaces of the integument that are prone to be the seat of moisture as well as other parts of the integument. It generally makes its appearance, and is most troublesome, during the hot and damp seasons. It is also

occasionally associated with tinea, which appears on its margin, or separately on other parts of the body.

"The remedy that I have found to be most certainly and rapidly effective is the solution in common vinegar or lemon-juice of Goa Powder. This rarely fails to effect complete removal of the disease after two or three applications repeated daily.

"The mode of application is to dissolve a few grains of the powder in common vinegar or lemon-juice to about the consistence of cream, and then paint the solution over the eruption and for a little distance beyond its margin on to the sound skin. It causes no pain at first, but in the course of a few hours there is a sensation of a dull heavy nature, as though the skin had been bruised, the eruption becoming white, whilst the surrounding skin is stained of a dark colour. The sense of uneasiness, however, soon passes away, and the integument resumes its natural characters; all traces of the disease disappear at the same time. Should any vestige of the eruption remain, or any indications of its return appear, a fresh application should be made. In a few days the dark discoloration of the skin begins to fade, gradually merging into the normal tint. At the same time a change takes place in the eruption, which gradually regains the natural colour of the skin; and by the time that the discoloration caused by the powder has disappeared, that of the eruption has also passed away, and the patient is well. Of course, it cannot be expected that these favourable results will always follow immediately. In chronic cases there is more obstinacy, and several repetitions of the application may be needed; but in recent examples the result will be generally favourable.

Chemical composition.—Chrysarobin is present in Goa powder to the extent of about 70 per cent., and when pure is a pale-yellow powder, consisting of small wart-like crystals made up of leaflets and acquiring on exposure a darker tint. By repeated crystallization from glacial acetic acid it is obtained pure in the form of small yellow scales, which are fusible and partly sublimable, nearly insoluble in water and ammonia,

sparingly soluble in alcohol, more freely soluble in amylic alcohol, ether, collodion, chloroform, and various hydrocarbons. It is inodorous, and, on account of its insolubility in water, tasteless. Chrysarobin dissolves in concentrated sulphuric acid with a yellow colour, is nearly insoluble in very diluted potassa solution, and yields with melted potassa a brown mass. Chrysophanic acid, on the other hand, dissolves in concentrated sulphuric acid and in very dilute potassa solution with a red colour, and on evaporation to dryness of a solution in alkali a violet or blue colour is produced. The solution of chrysarobin in strong potassa solution has a yellow colour and a strong green fluorescence, and on being agitated with air rapidly acquires a red colour; through the formation of chrysophanic acid; $C^{30}H^{26}O^{7}$ (chrysarobin) + $2O^{2}$ yields $2C^{15}H^{10}O^{4}$ (chrysophanic acid) + $3H^{2}O$.

Tests.—If boiled with 2000 parts of water, chrysarobin should not be completely dissolved; the filtrate should be pale reddish-brown, tasteless, neutral to test-paper, and should not be coloured by ferric chloride. Chrysarobin should be almost wholly soluble in 150 parts of hot alcohol. If a minute fragment of chrysarobin be added to a drop of fuming nitric acid, the red solution extended to a thin layer, and a little ammonia added a violet colour should be produced.—*P. G.* (*Stillé and Maisch.*) According to Allen, the *Chrysophanic acid* of commerce is an indefinite mixture of the acid and chrysarobin. It is stated to be liable to adulteration with picric acid and other yellow colouring matters.

Commerce.—Araroba is now very largely imported into India, and is sold under the names of Chrysarobine, Ararobine, and Goa Powder. Messrs. Kemp & Co. inform us that they import about a ton annually.

CÆSALPINIA PULCHERRIMA, *Swartz.*

Fig.—*Bot. Mag. t.* 995; *Rheede, Hort. Mal. vi.*, t. 1. Small Gold Mohar (*Eng.*), Fleur de paon, Haie fleurie (*Fr.*).

Hab.—Uncertain. Cultivated in India. *Syn.*—Poinciana pulcherrima.

Vernacular.—Gul-i-turah, Krishna-chura (*Hind.*, *Beng.*), Shankeshvar (*Mar.*), Mail-Kannai, Komri (*Tam.*), Kenjige (*Can.*).

History, Uses, &c.—This elegant shrub, named after M. de Poinci, once Governor of the Antilles, has become quite naturalized in India, and is one of the commonest of garden shrubs. According to Ainslie it was introduced into the Botanical Gardens in Calcutta in 1792. He gives the following description of it:—"The species in question is a most beautiful tree, which commonly rises to about 12 to 14 feet high, with leaves doubly pinnate, and leaflets oblong-oval, emarginate; they and the calices smooth; corymbs simple; petals fringed; stamens very long. It would appear to be a native of both the Indies; it is the Hoa-phung of the Cochin-Chinese; on the Malabar Coast it is called Tsietti-mandáru; in Ceylon, its common name is Monora-mal; and from its extreme beauty, Burmann gave it the appellation of 'Crista pavonis flore elegantissimo variegato.' The French in the West Indies call it 'Fleur de paradis.' The flowers come out in loose spikes at the extremity of the branches, the petals which have an agreeable odour, are beautifully variegated with a deep red or orange colour, yellow, and some spots of green." All parts of the plant are said to be emmenagogue and purgative, but there appears to be no record of any exact observations upon this point.

Description.—The bark is ash-coloured, smooth, thickly studded with small elliptic corky warts, the whole of the suber readily separates like birch bark, disclosing a streaky, mottled, green and pink surface, which is marked by numerous small scars corresponding to the warts above mentioned; the substance and internal surface of the bark is of a pinkish tinge. Taste rather nauseous, very astringent, microscopic structure not in any way peculiar, parenchyme loaded with starch, many cells contain red colouring matter.

POINCIANA ELATA, *Linn.*

Fig.—*Bedd. Fl. Syl.* 178.

Hab.—Western Pennisula. Cultivated elsewhere.

Vernacular.—Sandesra (*Guz.*), Vada-narayanan (*Tam.*).

Description.—An erect tree, 20—30 feet high. Leaves ½—¾ ft. long; pinnæ 10—16; leaflets 30—40, membranous, caducous, close, sessile, obtuse, ligulate. Flowers in corymbose racemes; pedicels obovoid; buds finely grey-downy; calyx very coriaceous, ¾—1 inch long, petals scarcely exserted, an inch broad, shortly clawed. Filaments bright red, 3—4 times the length of the calyx, downy near the base; pod 6—8 inches long by above an inch broad, 4—8 seeded. (*Flora Br. Ind.*) Much cultivated in Guzerat. The natives consider the leaves to be of a very hot nature and good for rheumatism and flatulence; they are much used by women after confinement, the dose being 3 tolas of the juice with 3 tolas of ghi every morning, and strict diet for 15 days. There is a superstition that the touch of the root removes the pain of a scorpion sting. The gum is dark-coloured and mucilaginous, but unimportant.

SARACA INDICA, *Linn.*

Fig.—*Bedd. Fl. Syl., t.* 57; *Burm. Fl. Ind.,* 85, *t.* 25, *f.* 2; *Wight Ic.,* t. 206; *Bot. Mag.,* 3018. The Asoka tree (*Eng.*), Jouésia Asjogam (*Fr.*).

Hab.—Himalaya to Ceylon. The bark.

Vernacular.—Asok (*Hind., Beng.*), Ashoka (*Mar.*), Asupála (*Guz.*), Ashogam (*Tam.*), Asoka (*Can.*).

History, Uses, &c.—This tree is covered with cymes of rich orange-coloured flowers in March and April which gradually turn red. In the fourth act of the Mricchakatika it is likened to a blood-stained warrior. Asoka is famed in Hindu

mythology from the circumstance of Sita, the wife of Rámchandra, having been protected from the caresses of the monster Rávana by a grove of the trees. It is the anthropogonic tree of the Vaisya caste, and a branch from it is brought to the house during their marriage ceremonies. In the Bhavaprakasha it is called Ganda-pushpa, or odorous flower; another name is Anganapriya, "dear to women." The tree is the emblem of love, and was burnt by the penitent Siva along with Kámadeva, the god of love, who wished to seduce him (*Kumárasambhava*, iii. 26); it is said to blossom when touched by the foot of a beautiful woman. (*Kálidasa.*) The name Ashoka signifies "free from pain;" in the Bhavaprakasha vermifuge properties are attributed to it, and in the Rajanighantu it is called Krimikaraka. At the Ashok-ashtami, or eighth day of the light fortnight of the month Chait (April-May), a festival in honour of Vishnu is observed in most parts of India, when part of the ceremonial consists in drinking water with the buds of the Asoka in it. The bark is much used by Hindu physicians in uterine affections, and especially in menorrhagia. Chakradatta directs a decoction of the bark in milk to be made by boiling eight tolas of it with eight tolas of milk and thirty-two tolas of water till the latter has evaporated. This quantity is given in two or three doses during the course of the day in menorrhagia. (*Dutt, Hind. Mat. Med., p.* 143.) Its properties appear to be purely astringent.

Description.—The bark is externally greyish-brown and scabrous; its substance white when freshly cut from the tree, but turning rapidly red after exposure to the air. The taste is mildly astringent and acidulous.

Chemical composition.—A decoction gave a greenish precipitate with ferric chloride, and a brownish sediment with solution of iodine in potassium iodide. It contained 10·3 per cent. of aqueous extract with 5·7 per cent. of tannin, and 13 per cent. of alcoholic extract with 8·8 per cent. of soluble and insoluble tannins. The ether extract was very pale brown and semi-crystalline. It was soluble in water, giving an emerald

green colour with ferric salts, red with soda solution, and dissolved in warm sulphuric acid with a purple colour changing to black—tests which point to the presence of catechin. The bark leaves 10·8 per cent. of mineral residue when burnt.

HARDWICKIA PINNATA, *Roxb.*

Fig.—*Bedd. Fl. Sylv.*, t. 255.

Hab.—Ghauts of Canara, Travancore, and the Carnatic.

Vernacular.—Koláva (*Tinnevelly*), Madeyan, Sampirani (*Tam.*), Yenne (*Can.*), Shurali, Kolla (*Mal.*).

Description, Uses, &c.—The following account of it has been extracted from the *Pharmacographia* :—" The tree, which is of a large size, belongs to the order *Leguminosæ*, and is nearly related to Copaifera. According to Beddome, it is very common in the dense, moist forests of the South Travancore Ghâts, and has also been found in South Canara. The natives extract the oleo-resin in exactly the same method as that followed by the aborigines of Brazil in the case of copaiba; that is to say, they make a deep notch reaching to the heart of the trunk, from which, after a time, it flows out.

" This oleo-resin, which has the smell and taste of copaiba, but a much darker colour, was first examined by one of us in 1865, having been sent from the Indian Museum as a sample of wood oil; it was subsequently forwarded to us in more ample quantity by Dr. Bidie of Madras. It is a thick, viscid fluid, which, owing to its intense tint, looks black when seen in bulk by reflected light; yet it is perfectly transparent. Viewed in a thin layer by transmitted light, it is light yellowish-green, in a thick layer vinous-red, hence is dichromic. It is not fluorescent, nor is it gelatinized or rendered turbid by being heated to 130° C., thus differing from wood oil. It may be further distinguished from wood oil as well as from copaiba, if tested in the following simple manner :—Put into a tube 19 drops of bisulphide of carbon and one drop of the oleo-resin,

and shake them together. Then add one drop of a mixture of equal parts of strong sulphuric and nitric (1·42) acids. After a little agitation the appearance of the respective mixtures will be as follows :—

"*Copaiba*—Colour faint reddish-brown with a deposit of resin on the sides of the tube.

"*Wood Oil.*—Colour intense purplish-red, becoming violet after some minutes.

"*Oleo-resin of Hardwickia.*—No perceptible alteration; the mixture pale greenish-yellow.

"By this test the presence in copaiba of one-eighth of its volume of wood oil may be easily shown.

"The balsam of Hardwickia has been used in India for gonorrhœa, and with as much success as copaiba." (*Op. cit.*)

Chemical composition.—Broughton, who has investigated it chemically, obtained by prolonged distillation with water an essential oil to the extent of 25 per cent. from an old specimen, and of more than 40 per cent. from one recently collected. The oil was found to have the same composition as that of copaiba, to boil at 225° C., and to rotate the plane of polarization to the left. The resin is probably of two kinds, of which one at least possesses acid properties. Broughton made many attempts, but without success, to obtain from the resin crystals of copaivic acid.

Trachylobium Hornemannianum, *Hoyne.*

Hab.—Africa. *Vernacular.*—Sandarús.

Gum Copal is administered internally in native practise as an astringent, anthelmintic, diuretic and emmenagogue; with honey it is applied to remove opacities of the cornea, with olive oil it is dropped into the ear in earache, made into an ointment it is applied to wounds to promote granulation; the fumes are inhaled in catarrh; made into an ointment with pitch it is applied to ringworm. In Ajmere fine shavings of the gum made

up into a medicine called *Khairva* are used to stop hæmoptysis. (*Irvine, Med. Top., p.* 132.) The gum is too well known as an article of commerce to require description.

CASSIA FISTULA, *Linn.*

Fig.—*Wight Ic., t.* 269; *Bentl. and Trim., t.* 87. Purging cassia, Indian Laburnum (*Eng.*), Casse Canéficier (*Fr.*).

Hab.—India, wild or planted. The fruit.

Vernacular.—Amaltás, Kirváli (*Hind.*), Bhava (*Mar.*), Gurmala (*Guz.*), Kakke-kàyi (*Can.*), Áhalla (*Cing.*), Konraik-kai, Sharak-konraik-kai, Mambala-konnai (*Tam.*), Sondhali (*Beng.*), Réla-káyalu (*Tel.*), Konnan (*Mal.*).

History, Uses, &c.—The Sanskrit names for the tree are Áragbadha, Suvarnaka (golden), and Rajataru, or Nripadruma (royal tree), on account of the beauty of the long racemes of yellow flowers, which resemble those of the Laburnum, but are much larger. It is sacred to Ganeshwar, the St. Januarius of India; in Mysore stakes cut from the tree are fixed in the ground and worshipped. In Hindu medicine the pulp is used as a cathartic, and the root is also sometimes given as a laxative. A compound decoction (Áragbadhadi) is directed to be used by Chakradatta; it contains Cassia pulp, *Picrorrhiza Kurroa,* Chebulic myrobalans, long pepper root and *Cyperus rotundus.* (*Dutt's Hindu Mat. Med., p.* 155.) In Mahometan works the drug is called Khiyar-shambar, an Arabic corruption of the Persian Khiyar-chambar, and the pulp Asal-i-Khiyar-chambar (honey of Khiyar-chambar). Chambar means a necklace in Persian, and is probably an allusion to the structure of the pod. Persian dictionaries give Katha-el-Hind (Indian cucumber) as the Arabic name. Through the Arabians the drug became known to the later Greek physicians. Nicolaus Myrepsicus calls it γλυκοκάλαμον. Joannes Actuarius, who practised at Constantinople towards the close of the 13th century, describes it minutely. * In the *Makhzan-el-adwiya*

* Meth. Med. v, 2.

the pods are directed to be slightly warmed, and the pulp extracted and rubbed up with a little almond oil for use. It is described as lenitive, useful for relieving thoracic obstructions, and heat of blood, a safe aperient for children, and women even when pregnant, but slow in its action. With tamarinds it is said to be a good purge for adust bile; with turbith or polypodium for cold humours and melancholy; with linseed or almond oil and combined with other suitable remedies, such as Dulcamara, it is recommended for the removal of obstructions of the abdominal viscera. Externally it is said to be a good application in gout, rheumatism, &c. The flowers and leaves are said to have lenitive properties, and a conserve of the former is mentioned. From 5 to 7 of the powdered seeds are prescribed as an emetic, and the shell of the pod rubbed down with saffron, sugar, and rose water, in difficult parturition. Ainslie notices the use of the pulp and flowers by the natives of India. Dr. Irvine (*Topogr. of Ajmeer*) states that he found the root act as a strong purgative. It is also reported to be in use as a purgative in Guzerat. In the Concan the juice of the young leaves is used to cure ringworm, and to allay the irritation caused by the application of the marking-nut juice. Rumphius remarks that the Portuguese make a confection of the young pods and also of the flowers. A peculiar gum swelling up in water like tragacanth issues from the tree when bruised. *C. brasiliana* and *C. moschata*, the Canafistola de purgar of Panama, Petite Casse d'Amérique of the French (*cf. Hanbury Science Papers*, p. 318), have been introduced into India, and have properties similar to those of *C. Fistula.*

Description.—The ovary of the flower is one-celled, with numerous ovules, which, as they advance towards maturity, become separated by the growth of intervening septa. The ripe legume is cylindrical, dark chocolate brown, 1½ to 2 feet long, by ¾ to 1 inch in diameter, with a short strong woody stalk, and a blunt end suddenly contracted into a point. The fibro-vascular column of the stalk is divided into two broad

parallel seams, the dorsal and ventral sutures running down the whole length of the pod. The sutures are smooth, or slightly striated longitudinally; one of them is formed of two ligneous bundles coalescing by a narrow line; each of the 25 to 100 seeds which a legume contains, is lodged in a cell formed by very thin woody dissepiments. The oval flattish seed, from 3-10th to 4-10th of an inch long, of a reddish-brown colour, contains a large embryo whose yellowish veined cotyledons cross diagonally, as seen on transverse section, the horny white albumen. One side is marked by a dark line (the raphe). A very slender funicle attaches the seed to the ventral suture. In addition to the seeds the cells contain a soft black pulp which has a mawkish sweet taste. (*Pharmacographia.*)

Chemical composition.—According to Braconnot, 20 parts of the pulp consist of sugar 12·00, gum 1·35, astringent matter, gluten, colouring matter and water make up the remaining portion, the water amounting to about 3·80.

C. Fistula roots.—The bark was carefully separated from the root-wood, the two dried separately and reduced to fine powder. The root-bark was astringent in taste, while the root-wood possessed a somewhat bitter-sweet flavour. The analysis showed the following results :—

	Root-bark.	Root-wood.
Water........................	10·01	8·21
Ash...........................	8·92	2·29
Petroleum ether extract...	·32	·52
Ether extract...............	2·17	·45
Absolute alcohol extract...	17·62	4·56

Manganese was absent in the ash both from the root-bark and root-wood; the former contained iron in very marked amount.

No alkaloidal principle could be detected; resins were present; astringent matter in very marked quantity in the root-bark, and to a small amount in the wood. The astringent matter was of the colour of kino, and afforded an inky coloration with ferric chloride; no gallic acid could be detected.

A principle soluble in petroleum ether was present both in the bark and wood, which yielded a bright red coloration with alkalies, the colour being changed to yellow by acids, and restored by alkalies. A bitter principle was also present to which the taste of the wood is probably due. In order to separate resins a large amount of the wood was exhausted with alcohol of 85 per cent., the alcohol evaporated off, water added to the extract, and the turbid mixture agitated with ether. During agitation chocolate-coloured flocks separated. The ethereal solution left on evaporation a reddish-yellow, soft, non-crystalline, and somewhat bitter residue. The aqueous solution, after dissolved ether had been expelled, was filtered to separate the chocolate-coloured flocks already mentioned, and the filtrate saturated with salt in order, if possible, to separate resin, but with negative results. The liquid was next agitated with acetic ether, the ether left on evaporation a slightly bitter principle, which was nearly wholly soluble in cold water. This principle, and the chocolate-coloured resin, insoluble in ether, were separately taken in doses of 0·1 of a gram. without producing any purgative action.

The pulp of *C. moschata* is in the form of dry circular discs, similar to small gun wads, of a light yellow colour, with a seed loose in the centre; it tastes astringent without any sweetness. The pulp dried at 100° C. lost 7·26 per cent. of moisture; on incineration it yielded 5·77 per cent. of ash, the composition of which presented nothing peculiar. To rectified spirit the pulp yielded 20·66 per cent. of extractive; dried at 100° C. the extract was acid; after extraction with cold water the insoluble residue was 4·55 per cent. calculated on the extract. This residue on drying formed dark easily friable lumps, which gave a dark chocolate coloured powder. In alkaline solutions it was soluble and was precipitated by acids in dark brown flocks; it had the properties of an acid resin. The aqueous solution of the alcoholic extract was concentrated, and when cold saturated with NaCl, light brown flocks separated; the liquid was filtered and the precipitate washed with a saturated solution of NaCl, the filter paper was then dried and digested

with absolute alcohol. The extract obtained on evaporating off the alcohol amounted to 2·74 per cent. This extract was of a light fawn colour, easily soluble in alkaline solutions, somewhat soluble in water, and precipitated imperfectly from its alkaline solution by acids. It also possessed the properties of an acid resin. The filtrate obtained after precipitation of the second resin by NaCl, while still acid, was agitated with ether, the ether extract amounted to 0·16 per cent. After separation of the ether the aqueous solution, still acid, was agitated with amylic alcohol, by which 2·77 per cent. of extractive was obtained. The amylic alcohol extract was astringent to the taste, precipitated gelatine, gave a dirty olive-green precipitate with ferric chloride, and yielded a reddish solution with alkaline hydrates; no further examination of the aqueous solution was made. The purgative principle would appear to be one or both of the resins, 0·2 gram. of the first resin was dissolved in a few drops of ammonia, the liquid heated to expel excess of NH^3, diluted with water, and injected into a full grown cat's stomach. In 3·5 hours the cat was purged.

The pulp of *C. brasiliana* is soft, dark and sweet, with an offensive odour; butyric acid was detected in it. A crystallizable acid, soluble in ether, was also separated, as well as an acid resin and saccharine matter, and a principle soluble in ether which had an odour somewhat like vanillin.

Commerce.—Cassia pods (Casse en bâtons, *Fr.*) are worth in India about Rs. 14 per kandy of 5 cwts.

CASSIA TORA, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 53; *Dil. Elt.* 63, *f.* 73.

Hab.—Throughout India. The leaves and seeds.

Vernacular.—Panwár, Chakaund (*Hind.*), Kovaria (*Guz.*); Tákala, Tarota (*Mar.*), Tantepu-chettu, Tagarisha-chettu (*Tel.*), Ushit-tagarai, Tagarai (*Tam.*), Takkarike, Tegarasi (*Can.*), Tora (*Cingh.*).

History, Uses, &c.—This plant is called by Sanskrit writers Chakramarda, "destroying ringworm," Prapunata or Prapunada, and Uranaksha; it has a great reputation in all kinds of skin-diseases. Chakradatta directs the seeds to be steeped in the juice of *Euphorbia neriifolia*, and afterwards to be made into a paste, with cow's urine as an application to cheloid tumours. He also recommends the seeds together with those of *Pongamia glabra* as a cure for ringworm. The Arabs call the seeds Ain-es-sarátin, or crab's eyes. Under the names of Sanjisaboyah and Sangisaboyah, Mahometan writers give an exact description of the plant, and notice the closing of the leaves at night. They consider the seeds and leaves to have solvent properties in those forms of skin-disease accompanied by induration, such as leprosy, cheloid, psoriasis, &c., and mention their having been used with advantage in plague (waba), a term which is rather indefinite. *C. Tora* and *C. Sophera* are named Gallinaria by Rumphius. (*Hort. Amb. v.*, 97, figs. 1, 2.) Ainslie says:—"The mucilaginous and fetid smelling leaves of *C. Tora* are gently aperient, and are prescribed in the form of decoction; and in doses of about 2 ounces, for such children as suffer from feverish attacks while teething; fried in castor oil they are considered as a good application to foul ulcers. The seeds ground with sour buttermilk are used to ease the irritation of itchy eruptions; and the root, rubbed on a stone with limejuice, is supposed to be one of the best remedies for ringworm. The leaves are also used as a poultice to hasten suppuration." The plant is to be found as a weed in every garden, and is used as a domestic remedy in the manner described by Ainslie. In the Concan the following prescription is used for itch:—*Cassia Tora* seeds, 6 parts; *Psoralia corylifolia* seeds, 4 parts; carrot seeds, 2 parts; powder, soak in cow's urine eight days, and apply. Lately the seeds have been recommended as a Coffee-substitute. They are also used as a dye.

In India the young leaves are cooked and eaten on the four Saturdays in the month of Shravan; they are one of the five

vegetables particularly acceptable to the gods; the others are *Bauhinia malabarica, Amarantus gangeticus, Celosia argentea,* and *Phalangium tuberosum.*

Description.—Leaflets 3 pairs, obovate, obtuse, glabrous, the terminal pair being much the largest, all folding up closely at night; flowers axillary, generally in pairs, dull yellow; legumes about 6 inches long, narrow, quadrangular, about ⅛ of an inch in diameter, containing numerous elongated, very hard greyish seeds, the ends of which appear as if cut off obliquely. The whole plant has a fetid smell. The leaves when full grown are mucilaginous, and have a nauseous taste, but when young they are much used as a vegetable.

Chemical composition.—The seeds have been examined by Elborne (*Pharm. Journ., Sept. 22nd,* 1888), who found them to have the following percentage composition:—

Water	27·2
Petroleum ether extract	9·75
Ether extract	·86
Absolute alcohol extract	1·63
Watery extract	20·00

The ethereal extract and the alcoholic extract contained a glucosidal substance of a yellow colour insoluble in water, soluble in alcohol and in watery solutions of potash with a blood-red colour. These solutions are precipitated by hydrochloric acid. The precipitate has great analogies with chrysophanic acid, but according to Elborne appears to correspond with emodin in composition. Emodin ($C^{15}H^{10}O^{5}$) is trioxymethylanthraquinone and chrysophanic acid dioxymethylanthraquinone. The properties of the plant are due to the presence of emodin. In order to extract it the powdered seeds should be treated with dilute alcohol, the tincture filtered, and the alcohol distilled off. The residue is then to be diluted with water, acidulated with hydrochloric acid, boiled for ten minutes, and when cold agitated with ether which dissolves the emodin. Emodin agrees with chrysophanic acid in most of its properties,

but may be distinguished by its insolubility in benzine, and greater solubility in ether and alcohol.

The leaves of this shrub contain a principle similar to cathartin, and a red colouring matter as in Senna leaves. They yield 18 per cent. of mineral matter on incineration.

Cassia alata, *Linn.*, *Wight Ic.*, *t.* 253, is not a native of India, but has been introduced from the West Indies, where it has a reputation as a remedy for ringworm, and is used internally to promote expectoration, the action of the bowels and the secretion of urine.

The evidence which was collected by the authors of the *Pharmacopœia of India* is strongly in favour of its efficacy, and supports the favourable opinion of it expressed in the *Bengal Dispensatory.* The best way of applying it is to bruise the leaves and mix them with limejuice, the paste thus prepared is spread upon the affected part. The leaves have also purgative properties, and have been used in the same manner as Senna.

Description.—The leaves are two feet long or more, and consist of a triangular petiole, with from 8 to 14 pairs of leaflets. The first pair are the smallest, and are placed near the branch and separated from the second pair by a longer interval than there is between the other pairs. The terminal leaflets are as much as 5 to 6 inches in length. They are all obovate-oblong, obtuse, mucronate, and glabrous on both sides, and taste like Senna, but less nauseous.

This shrub has no proper Vernacular names, but is known in Southern India as "*foreign Sesbania grandiflora,*" *e. g.*, Shimai-agatti (*Tam.*), and in Bengal as "*Ringworm shrub,*" Dádmar-dan. Late Sanskrit writers have given it the name of Dádrughna, which has the same meaning.

CASSIA AURICULATA, *Linn.*

Fig.—*Pluk. Alm.*, *t.* 314, *f.* 4.

Hab.—Central Provinces, W. Peninsula, Ceylon. The bark and seeds.

Vernacular.—Tarwar (*Hind., Mar.*), Avala (*Guz.*), Avirai (*Tam.*), Tangedu (*Tel.*), Tangádi-gida, Avara-gida (*Can.*), Ranavara (*Cingh.*).

History, Uses, &c.—Ainslie says:—"The small, flat, pleasant-tasted, heart-shaped seeds of this species of Cassia, the Vytians reckon amongst their refrigerants and attenuants, and prescribe them in electuary, in cases in which the habit is preternaturally heated, or depraved. They also consider the powder of the dry seeds as a valuable external remedy (blown into the eye), in certain stages of ophthalmia; of the electuary the dose is a small teaspoonful twice daily. Dr. Kirkpatrick (*Cat. of Mysore Drugs*) brings to notice the astringent properties of the bark, and speaks favourably of the use of the seeds as an application to the eyes in chronic purulent conjunctivitis.

C. auriculata is of great importance to the tanner; and to workers in iron, who use the root in tempering iron with steel. (*Gibson.*). Another common use to which the wood is applied is the making of Datwans, or native tooth-brushes; for this purpose it is preferred to that of any other plant. The shrub yields an adhesive gum.

Dr. P. S. Mootooswamy informs us that in Tanjore the root is used in decoction as an alterative, as well as a medicinal oil prepared from the bark, which is called in Tamil *áverai-yennai.* The leaves infused yield a cooling drink, and ground to a paste with water and the seeds of *Phaseolus radiatus* and poppy seed they are applied to herpetic eruptions. From the flowers a tea is prepared which is prescribed in diabetes. A compound syrup is prepared with the flowers, mocharas, and Indian sarsaparilla which is prescribed for nocturnal emissions. The seeds are also used in diabetes and ophthalmia, a compound powder made with all the parts of the plant is considered a specific in the former affection; it is called *áverai-panjhangum* in Tamil, and is administered mixed with honey in doses of a tea-spoonful. Dr. Mootooswamy states that he has known diabetes and chylous urine to be cured by it.

Description.—The bark as generally met with is about as thick as cinnamon, nearly smooth, externally reddish-brown, internally olive-green; it occurs in small strips or quills. Taste sweetish, and moderately astringent. Sections examined under the microscope show a deposit of crystals arranged like rows of beads in the course of the vessels, otherwise there is nothing remarkable. The seeds are smooth, flat, of an oval, oblong, or obscurely triangular form, obtusely pointed at one end. Their colour is brown, or dull olive-green; they are tasteless and inodorous.

Chemical composition.—The young bark yields 22·3 per cent. of aqueous extract, and 24·8 per cent. of alcoholic extract; in the former was estimated 11·9 per cent. of tannin, and in the latter 14·2 per cent. The tannin gave a greenish precipitate with ferric salts. The bark contained 7·3 per cent. of moisture and 4·1 per cent. of ash.

CASSIA SOPHERA, *Linn.*

Fig.—*Jacq. Ic., t.* 73; *Rheede, Hort. Mal. ii., t.* 52.

Hab.—Himalayas to Ceylon. Cosmopolitan in the tropics. The leaves, seeds and roots.

CASSIA OCCIDENTALIS, *Linn.*

Fig.—*Bot. Reg. t.* 83. Negro Coffee (*Eng.*), Cafetier des négres (*Fr.*).

Hab.—Cosmopolitan in the tropics, probably introduced into India. The seeds and leaves.

Vernacular.—Kasondi, Gajarság, Sari-Kasondi (*Hind.*), Rántákala (*Mar.*), Kasonda (*Beng.*), Ponna-virai, Pera-verai (*Tam.*), Tagara-chettu, Paidi-tangedu (*Tel.*), Dodda-tagase (*Can.*).

History, Uses, &c.—Cassia Sophera, in Sanskrit Kasamarda, "destroyer of cough," is a native of India, whilst *C. occi-*

dentalis appears to have been introduced, but is a widely scattered plant from the Himalayas to Ceylon. The natives usually call both plants by the same name, but if they wish to distinguish them the adjective 'black' is applied to *C. Sophera.*

These plants are supposed by the Hindus to have expectorant, depurant and alterative properties, and the roots are given with black pepper as a remedy for snake bites. The seeds of *C. Sophera* and of *Raphanus sativus* are rubbed into a paste with sulphur and water and applied to patches of pityriasis and psoriasis, and a paste of the root with sandalwood is used for the same purpose. Mahometan writers treat the two plants as varieties of the same species; they describe Kasondi as alexipharmic, useful in the expulsion of corrupt humours and to relieve cough, especially whooping cough. Both plants are purgative, the dose of the leaves being about 90 grains. In the Concan 4 to 12 grains of the seeds are pounded and heated with 3 drachms of women's or cow's milk, strained, and given once a day as a cure for the convulsions of children, or a larger dose may be given to the mother or wet nurse; as in the case of senna, the purgative effects are communicated to the milk.

In the French-African colonies the seeds of *C. occidentalis* are called "negro coffee;" they are employed there and in the West Indies as a febrifuge, chiefly in the form of vinous tincture (℥ii to Oij of Malaga wine), an infusion of the root is considered by the American Indians to be an antidote against various poisons, and a decoction of the whole plant is a popular remedy in hysteria; it relieves spasm and expels wind in the intestines. Torrefaction is said to destroy the purgative principle in the seeds, and make them taste like coffee.

In Gambia the root is used as a preventive of fever, a decoction being taken every morning; and the leaves are applied in erysipelas and local inflammations.

Description.—*C. Sophera.*—Erect, branched, glabrous; leaflets 6 to 12 pair, lanceolate, or oblong-lanceolate, acute; with a single gland near the base of the petiole; racemes terminal or axillary, few flowered; upper petal retuse;

legumes long, linear, turgid, glabrous, many-seeded; suture keeled; seeds horizontal with cellular partitions; flowers middle-sized, yellow. The plant has a heavy disagreeable smell, and a purplish tinge; the root is fibrous and woody, with a blackish bark giving it the appearance of having been burnt, and has a strong odour of musk. It springs up upon waste ground during the rains, and flowers in November. The plants often last for several years, and attain a considerable size.

C. occidentalis.—Erect, branches glabrous; leaflets 3 to 5 pairs, without glands between them, ovate-lanceolate, very acute, glabrous on both sides; petiole with a large sessile gland near its tumid base; flowers longish-pedicelled, yellow, upper ones forming a terminal raceme, lower ones 3 to 5 together on a very short axillary peduncle; legumes long, surrounded with a tumid border. The seeds are of a grey colour, and of the shape of rounded discs, from $\frac{3}{16}$ to $\frac{4}{16}$ of an inch in diameter, and $\frac{1}{16}$ of an inch in thickness. The plant appears in the rains upon waste ground and rubbish; it has a sickly offensive smell, and closely resembles *C. Sophera.*

Chemical composition.—The roots of *C. Sophera* contain a resinous substance affording fine red solutions with alkalies, and a bitter principle, not of an alkaloidal nature, in the aqueous solution of the alcoholic extract. Water dissolves out a red pigmental glucoside yielding a decomposition product insoluble in water. The leaves contain cathartin, colouring matter, and 12 per cent. of saline residue. Examined by Clonet (1876), the seeds of *C. occidentalis* were found to contain:—Fatty matters (olein and margarin), 4·9; tannic acid, 0·9; sugar, 2·1; gum, 28·8; starch, 2·0; cellulose, 34·0; water, 7·0; calcium sulphate and phosphate, chrysophanic acid, 0·9; malic acid, sodium chloride, magnesium sulphate, iron, silica, together, 5·4; and achrosine, 13·58 parts in 100. The latter substance was obtained by exhausting the powder of the seeds previously treated with ether, by means of alcohol of 60 per cent. The alcohol is distilled off, the syrupy residue treated with absolute alcohol, which dissolves out various constituents, leaving a solid brown

red mass, having when dry a resinous fracture, and being soluble in water, to which it communicates a garnet colour. It contains C,H,O,N, and S, but its exact composition has not been determined (it is most likely a mixture of various bodies). It is soluble also in weak alcohol, and in acids and alkalies. The colour cannot be fixed upon tissues by any known mordant. This circumstance induced Professor Clonet to term it achrosine, or "not colouring," although being coloured itself. The seeds are the most active part of the plant, and readily act as an emeto-cathartic. (*Year-Book of Pharmacy*, 1876, *p.* 179.)

We have separated the colouring matter as above described, and after dissolving in water and filtering, the solution was boiled, whereupon most of the colour was thrown down as a brown precipitate. The precipitate was well washed, dried and powdered. The powder, of a greenish brown colour, was very soluble in ether and alcohol, and sparingly soluble in benzol, and separated on evaporation of the solvent into yellow crystals which became red on exposure to the air. It melted at 245° C., and at a higher temperature gave off yellowish green fumes partly subliming in yellow needles which struck a fine red colour with caustic potash and orange brown with sulphuric acid. These and other tests indicate the presence of an anthraquinone derivative very closely allied to emodin.

The powdered seeds burnt with soda lime yielded 2·75 per cent. of nitrogen, which, calculated into proteids, shows the presence of 17·4 per cent.

Commerce.—The seeds of these plants are not collected in India, but in Senegal they are used as a coffee substitute, and are exported to some extent.

CASSIA ABSUS, *Linn.*

Fig.—*Burm. Zeyl., t.* 97.

Hab.—W. Himalayas to Ceylon. The seeds.

Vernacular.—Châksú, Châkút (*Hind.*), Kánkuti, Chimr (*Mar.*), Chinol (*Guz.*), Karunkánam, Káttukkol (*Tam.*), Chanupála-vittulu (*Tel.*), Bu-tora (*Cing.*).

History, Uses, &c.—These seeds were used by the ancient Egyptians, through them the Greeks and Romans became acquainted with the drug. Dioscorides notices them as produced in Egypt, and calls them Akákális.* Mahometan writers following the Greeks describe the seeds as attenuant and astringent, and say that they strengthen the sight when used as a collyrium; they direct them to be prepared by enclosing them in a little dough and placing them inside an onion, which is then baked. The Arabic names for the seeds are Hab-es-soudán, and Tashmízaj, the latter being a corruption of the Persian Chashmizak. In Persia they are also called Cheshmak and Chashúm. According to Ibn Baitar, those which come from the Soudan are the largest and best. In some books a plaster made from the seeds is recommended as an application to wounds and sores, especially of the penis. In purulent conjunctivitis about a grain of the powdered seed prepared in the manner already mentioned is introduced beneath the eyelids. M. Cailliaud gives us the following description of the use of the seeds in Egypt:—"On concasse les grains et on les monde de leur tunique; elles se réduisent en une poudre jaunâtre que l'on met sèche en petite quantité à l'intérieur de la paupière inférieure, que l'on a eu soin d'abaisser. On verse la poudre entre le globe de l'œil et la paupière, en faisant tomber doucement cette poudre de dessus une petite pièce de monnaie où on l'a placée. Cette application cause une cuisson et une gêne, qui font tenir les paupières fermées, et qui font couler des larmes. La douleur se dissipe par degrés, en une demi-heure ou un peu plus; et les yeux, qui étaient fort injectés de sang avant et pendant l'opération, diminuent de rougeur, reprennent l'éclat de la santé, et font succéder une sensation de bien-être à l'appesantissement et á l'incommodité qui ont précédé. L'expérience nous a fait concevoir l'utilité de ce remède, dans le cas où l'inflammation, devenue chronique, est entretenue par un relâchement des parties. (*Centurie de Plantes d'Afrique*, p. 26.) The drug was tried by Dr. Harbauer at Brussels in 1822

* Dios. i., 103.

with satisfactory results. (*Confer. Graefe and Walthers Jour.*, 1825, Vol. VI., p. 1.) Dr. G. Smith, who tried it in the Eye Infirmary at Madras, thinks it a painful and dangerous application in ophthalmia and granular lids. He does not say, however, whether the seeds were baked before they were applied.

Description.—Cháksu seeds are black and polished, flat, of an irregular oval or oblong shape; the end where the hilum is situated is rather more pointed than the other, length and breadth nearly alike, about $\frac{1}{3}$ to $\frac{1}{6}$ of an inch; testa horny and thick; cotyledons yellow; taste bitter.

Chemical composition.—The seeds reduced to fine powder lost 13·54 per cent. at 100° C. The ash amounted to 3·74 per cent., and contained a trace of manganese.

On analysis the following results were obtained:—

Petroleum ether extract	....	6·24	per cent.
Ether ,,	....	·16	,,
Absolute alcohol ,,	....	1·75	,,
Cold water ,,	....	22·56	,,

The petroleum ether extract was of a bright yellow colour, and consisted of a non-drying oil, insoluble in alcohol. No red coloration was produced by alkalies: saponified with alcoholic potash, and the soap treated with petroleum ether, it yielded no extractive.

The ether extract consisted wholly of a trace of oily matter, completely soluble in petroleum ether.

The alcoholic extract was yellow, brittle, and hygroscopic, and without bitterness. By treatment with water a yellow solution was produced which gave a brown coloration with ferric chloride. Extracted with water acidulated with sulphuric acid, the solution afforded marked indications of the presence of an alkaloidal principle. Alkalies imparted a bright yellow coloration to the solution. The extract also contained a yellow resin insoluble in alkalies.

The aqueous extract reduced an alkaline copper solution on boiling, and gave a precipitate with acetic acid and ferrocyanide of potassium.

The residue insoluble in water contained no starch.

Commerce.—The seeds are collected in many parts of India. Value, Rs. 4 per Surat maund of 37½ lbs.

CASSIA ANGUSTIFOLIA, *Vahl.*

Fig.—*Royle Ill., t.* 37; *Bentl. and Trim., t.* 91. Senna (*Eng.*), Séné (*Fr.*). The leaves.

Hab.—Africa. Cultivated in India.

Vernacular.—Sana-maki, Sona-maki (*Hind., Mar., Guz.*), Nilavirai (*Tam., Can.*), Nelaponna (*Tel.*).

History, Uses, &c.—Senna was first used as a purgative medicine by the early Arabian physicians, who introduced it into Europe. The Sana-maki of native works on Materia Medica is Arabian Senna imported into India. The same species has latterly been cultivated in this country, especially about Tinnevelly, from which place large quantities of the leaf are exported to Europe. In the Bombay market Indian grown Senna is now always obtainable; much also passes through the port on its way to Europe, being brought up from Tuticorin by the steamers which ply round the coast. Bombay is, moreover, the chief port for the importation of Arabian Senna, which is shipped from Mokha, Aden, and other Red Sea ports, and, re-exported, is known in Europe as Bombay Senna.* Sana-maki is described in native works on Materia Medica as a purgative of phlegm and adust bile, clearing the brain, and acting as an attenuant of the system generally; it is considered especially useful in those diseases which are caused by an accumulation of corrupt humours, such as gout, rheumatism, &c. It is also thought to clear the skin of pimples, to expel worms from the intestines, and to remove any tendency to piles. Senna is prescribed in decoction and as a confection. A plaster made by mixing the powdered leaves with vinegar

* The importation of Arabian Senna is rapidly declining owing to the large quantity of Tinnevelly leaves now offered at extremely low rates.

is recommended in skin affections; and combined with Henna is used to dye the hair black. In the Concan the seeds with those of *Cassia Fistula* are pounded with curds and applied to cure ringworm; the seeds of *Cassia obovata* are used in a similar manner. Senna appears to have been introduced into Europe by the Arabians about the ninth century. In France, in 1542, a pound of Senna was valued at 15 sols, the same price as pepper or ginger. The Arabian Senna, called Sana Hajazi or Jabali, is the produce of the uncultivated plant; it is collected by the Arabs in a careless manner, and is much mixed with pods, flowers, and portions of the stem; the natives consider the pods to be quite as efficacious as the leaves.

The therapeutic action of Senna pods, as differing widely from that of Senna leaves, is the subject of an interesting note by Dr. A. W. Macfarlane. (*Lancet, July 27th*, 1889.) He finds that an infusion of the pods presents the advantage of being almost free from taste and devoid of the characteristic odour and flavour of the leaves. It appears to increase activity in the muscular movements of the whole gastro-intestinal canal, acting quite as much on the colon and rectum as on the small intestine. It is slower in its action than an infusion of the leaves, but equally certain; an ordinary dose producing one motion, seldom more, of soft consistence, in from eight to ten hours, without exciting congestion of the pelvic vessels, increasing hæmorrhagic or menstrual discharges, or causing griping or flatulence. When administered regularly for several nights, it promotes the natural evacuation of the bowels, so that the quantity taken has to be decreased and eventually stopped. It has been found useful in cases of hæmorrhoids and in constipation of children as well as the aged.

Description.—Leaves 5—8, jugate, oval-lanceolate, tapering from the middle towards the apex, from 1 to 2 inches long, glabrous or scantily pubescent, pale or subglaucous, subsessile. Legume from 7 to 8 lines broad; with the base of the style distinctly prominent on its upper edge; seeds obovate-

cuneate, compressed; cotyledons plain, extending thelarge diameter of the seed in transverse section. (*Oliver.*)

Chemical composition.—According to the researches of Lassaigne and Feneulle (1821), Bucheim and Lundermann (1856) and Kubly (1865), the active principle of senna leaves is *cathartin*, a combination of *cathartic acid* with one or more earthy bases. Cathartic acid has been shown to be formed of carbon, hydrogen, oxygen, nitrogen and sulphur; it is quite soluble in alcohol, but the salts are insoluble, hence the cathartin is prepared by precipitating an aqueous extract with a large excess of rectified spirit. The active principle of Senna is, according to D. R. Stockman (1885) (*Arch. für exper. Pathol und Pharm. and Pharm. Journ.* [3], *XV.*, 749,) a yellow colouring matter, not containing any nitrogen or sulphur, and derived from a mixture of a derivative of anthracene with a colloid hydrate of carbon. Dr. Stockman obtained this substance by treating Senna leaves with alcohol acidulated with weak sulphuric acid, afterwards with hot alcohol; the result of this process was precipitated by hydrate of baryta. In the precipitate and in the filtered liquid cathartic acid is found, which is dissolved and shaken with ether, and the acid is then combined with baryta or lead. The liquid which contains the active principle is evaporated after being treated with sulphuretted hydrogen, and the resulting product dried over sulphuric acid.

A solution of this substance neutralised by carbonate of soda and administered to rabbits produced a violent diarrhœa, in large doses it is poisonous; injected hypodermically or into the veins it produces no effect. (*Archiv. der. Phar.*, *Journ de Phar. et de Chim.*, 1886.)

The sugar of Senna leaves was isolated by Kubly in 1865, and named *Catharto-mannit.* A. Seidel, 1885, has further examined this substance, for which he proposes the name "*Sennit.*" The most satisfactory process for preparing this sugar was by concentrating in vacuo the aqueous infusion of the leaves, precipitating mucilage and salts from the syrupy liquid by two volumes of strong alcohol, filtering, distilling off the alcohol,

diluting the residue with water, digesting for 24 hours with oxide of lead, again evaporating in vacuo to a syrupy consistence, crystallizing upon flat plates over quicklime, which requires four or five weeks, and purifying by recrystallization from methyl alcohol and washing with absolute alcohol. Thus prepared sennit has the composition $C^6H^{12}O^5$, and forms colourless microscopic hemiedric crystals of the rhombic system, mostly sphenoids with curved sides. It has a very sweet taste, melts at 183° C. (corrected 185·°6), and is soluble at the ordinary temperature (about 20°C.) in $1\frac{5}{8}$ parts of water, 450 of absolute alcohol, 48 of alcohol of 90 p. c., 82 of methyl alcohol, and about 10 500 parts of absolute ether. It is dextrogyrate, unfermentable, prevents the precipitation of copper and iron salts by alkalies, and does not reduce Fehling's solution (even after boiling with acid), silver nitrate, or solutions of gold or platinum. By treatment with dilute nitric acid, it yields oxalic acid, but no mucic acid. On evaporating sennit with an excess of dilute nitric acid, a snow-white mass is left, which dissolves with an intense yellow or yellowish colour in sodium acetate; on the addition to the ammoniacal solution of a drop of barium chloride solution, a reddish brown precipitate is produced, the liquid gradually becomes rose-coloured, and on spontaneous evaporation leaves a raspberry red residue. Similar colorations are produced by strontium chloride, but the residue is in transmitted light rose-coloured, while in reflected light it is green, and has a metallic lustre. These characteristic colour reactions are at once produced in the solution in sodium acetate mentioned above. Inosit, quercit, and probably pinit, give a similar reaction; but not mannit, dulcit, glucose or saccharose. Compounds with calcium, barium and lead were prepared; also an acetyl compound, showing sennit to be a pentatomic alcohol. (*Amer. Jour. Pharm., Nov.,* 1885; *Year-Book of Pharm.,* 1886.) Two comparative experiments with senna pods by E. F. Salmon (*Pharm. Journ., Oct.* 12*th,* 1889) showed that they are richer in cathartin than the leaves, and are practically free from the resins and volatile oil contained in them.

From the examination of the ash of some samples of Tinnevelly senna, Heisch reports that the average is 11·35 per cent.; of this 2·43 parts are soluble in water, 8·66 are soluble in acid, and 0·26 are insoluble. This composition is very similar to that of the ash of Alexandrian senna leaves.

It has been shown in a paper by C. L. Diehl (*Pharm. Journ., March 18th*, 1876), that senna leaves when treated with alcohol and dried, will give preparations, which while possessing the purgative qualities of the leaves, are tasteless and do not gripe.

Cold water readily dissolves the cathartin from the pods, which it will not do from the leaf, owing to the impervious nature of its epidermis.

Commerce.—The imports of Arabian Senna into Bombay for many years amounted to about 5,000 cwts. annually; half this quantity was re-exported. Value, Rs. 5 to 6 per cwt. It was brought from Jedda, Aden, and Zanzibar, but now it is hardly obtainable, having been driven out of the market by Tinnevelly Senna.

Tinnevelly Senna is exported from Tuticorin, and the season for collecting the leaves extends from June to December. The exports during the last five years were as follows:—

Year.	Foreign.		British Ports in other Presidencies.		British Ports within the Presidency.		Total.	
	Cwts.	Value, Rs.	Cwts.	Value, Rs.	Cwts.	Value, Rs.	Cwts.	Value, Rs.
1883-84 ...	8,469	83,772	1,682	16,343	...	...	10,151	1,00,115
1884-85 ...	6,688	83,494	4,364	32,208	...	...	11,052	1,15,702
1885-86 ...	9,575	36,369	2,506	32,302	139	780	12,861	69,451
1886-87 ...	10,205	1,39,808	2,911	31,904	...	...	13,116	1,71,712
1887-88 ...	17,422	2,66,690	3,954	52,179	...	...	21,376	3,18,869

CASSIA OBOVATA, *Collad.*

Fig.—*Wight Ic., t.* 757; *Bentl. and Trim., t.* 89. Italian Senna (*Eng.*), Sené d' Italie (*Fr.*).

Hab.—Punjab, Sind, W. Peninsula. The herb.

Vernacular.—Surati-sonamukhi (*Guz.*), Bhui-tarwar (*Mar.*), Nilavagai (*Tam.*)

Description, Uses, &c.—This plant is the *C. obtusa* of Roxburgh. It is very common in many parts of India, but is not cultivated. The whole plant in seed is sometimes offered for sale in the bazar as country senna, in contradistinction to the senna which is in general use, and which was formerly imported from Arabia. *C. obovata* is perennial, herbaceous, and diffuse; leaflets 4 to 6 pair, obovate obtuse, mucronate, glabrous; racemes axillary, few flowered, much shorter than the leaves; legumes lunate, broad, thin, obtuse; valves crested at the seeds. It is used as a substitute for the official Senna, and is also in Southern India applied to cure psoriasis and pityriasis. The following notice of it occurs in the *Pharmacographia*:—"This species was the first known to botanists, and was cultivated in Italy for medicinal use during the first half of the 16th century. Hence the term Italian senna used by Gerarde and others. It is more widely distributed in the Nile region than the other species, and is also found in India, and (naturalized) in the West Indies. Its leaflets (also pods) may occasionally be picked out of Alexandrian senna. It is called by the Arabs *senna baladi* (wild senna), and grows in the fields of durra (*Sorghum*) at Karnak and Luxor, and in the time of Nectoux was held in such small esteem that it fetched but a quarter of the price of the *senna jebeli* brought by the caravans of Nubia and the Bisharrin Arabs. It is not now collected."

Being very abundant in India it might occasionally be found useful as a substitute for officinal Senna. In the earlier part of the season it is frequently found mixed with the Tinnevelly senna, and is known in South India as the blunt leaf or jungle senna.

Chemical composition.—See *Cassia angustifolia.*

Other allied plants sometimes used medicinally in India are **Cynometra ramiflora,** *Linn.,* which has purgative pro-

perties, and the leaves of which, boiled in milk and mixed with honey, are used as an application to scaly cutaneous eruptions In Nepaul the leaves of **Colutea nepalensis**, *Sims.*, are used as a purgative.

TAMARINDUS INDICA, *Linn.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 184; *Bentl. and Trim.*, *t.* 92.

Tamarind tree (*Eng.*), Tamarinier de l'Inde (*Fr.*). The pulp, leaves and seeds.

Hab.—Africa (?) Cultivated throughout the tropics.

Vernacular.—Imlí, Amlí (*Hind.*, *Guz.*), Chintz (*Mar.*), Puliyam-pazham (*Tam.*), Tentul (*Beng.*), Chin̓ta-pandu (*Tel.*), Hunase (*Can.*).

History, Uses, &c.—There would appear to be little doubt that the Tamarind tree is a native of some part of India, probably the South. It is found in a cultivated or semi-cultivated state almost everywhere, and the fruit, besides being an important article of diet, is valued by the Hindus as a refrigerant, digestive, carminative and laxative, useful in febrile states of the system, costiveness, &c. The ashes of the burnt suber are used as an alkaline medicine in acidity of the urine and gonorrhœa, the pulp and also the leaves (puliyam-gali, *Tam.*), are applied externally in the form of a poultice to inflammatory swellings.

The Sanskrit names of the Tamarind are Tintidi and Amlika. The word 'Tamarind' appears to be derived from the Arabic Tamar-Hindi (Indian date), and it was doubtless through the Arabians that a knowledge of the fruit passed during the Middle Ages into Europe, where, until correctly described by Garcia d'Orta, it was supposed to be produced by a kind of Indian palm.

The author of the Makhzan-el-Adwiya describes two kinds, *viz.*, the red, small-seeded Guzerat variety, and the common reddish brown. The first is by far the best. Mahometan

physicians consider the pulp to be cardiacal, astringent and aperient, useful for checking bilious vomiting, and for purging the system of bile and adust humours; when used as an aperient it should be given with a very small quantity of fluid. A gargle of Tamarind water is recommended in sore throat. The seeds are said to be a good astringent, boiled they are used as a poultice to boils, pounded with water they are applied to the crown of the head in cough and relaxation of the uvula. The leaves crushed with water and expressed yield an acid fluid, which is said to be useful in bilious fever, and scalding of the urine; made into a poultice they are applied to reduce inflammatory swellings and to relieve pain. A poultice of the flowers is used in inflammatory affections of the conjunctiva; their juice is given internally for bleeding piles. The bark is considered to have astringent and tonic properties. (*Makhzan-el-Adwiya.*) The natives consider the acid exhalations of the Tamarind tree to be injurious to health, and it is stated that the cloth of tents allowed to remain long under the trees becomes rotten. Plants also are said not to grow under them, but this is not universally the case, as we have often seen fine crops of *Andrographis paniculata* and other shade loving plants growing under Tamarind trees. Mr. J. G. Prebble has brought to our notice a peculiar exudation from an old tamarind tree. It consists almost entirely of oxalate of calcium, and flows from the tree in a liquid or syrupy state, but afterwards dries into white crystalline masses.

Description.—The fruit is an oblong or linear-oblong, slightly compressed, curved, or nearly straight, pendulous legume, of the thickness of the finger, and 3 to 6 inches in length, supported by a woody stalk. It has a thin but hard and brittle outer shell or epicarp, which does not split into valves, or exhibit any very evident sutures. Within the epicarp is a firm, acid juicy pulp, on the surface of which and starting from the stalk are strong woody ramifying nerves; one of these extends along the dorsal (or concave) edge, two others on either side of the ventral (or convex) edge, while between these two there are usually 2 to 3, or 4 less regular and more slender nerves,

all running towards the apex and throwing out branching filaments. The seeds, 4 to 12 in number, are each enclosed in a tough, membranous cell (endocarp), surrounded by the pulp (sarcocarp). They are flattened, and of irregular outline, being roundish ovate, or obtusely four-sided, about 6-10th of an inch long by 3-10th thick, with the edge broadly keeled or more often slightly furrowed. The testa is of a rich brown, marked on the flat sides of the seed by a large scar or areole, of rather duller polish than the surrounding portion, which is somewhat radially striated. The seed is exalbuminous, with thick hard cotyledons, a short straight included radicle and a plumule in which the pinnation of the leaves is easily perceptible. (*Pharmacographia.*) The Indian commercial article forms a firm, black, sticky mass; with the pulp are mixed seeds, fibres and small fragments of the shell; it is usually salted. For pharmaceutical purposes it should be free from salt.

Microscopic structure.—Tamarind pulp consists of thin-walled cells; amongst them may be seen crystals, which are probably acid tartrate of potash.

Chemical composition.—According to Flückiger and Hanbury water extracts from unsweetened Tamarinds, sugar together with acetic, tartaric, and citric acids, the acids being combined for the most part with potash. The neutralized solution reduces alkaline cupric tartrate after a while without heat, and therefore probably contains grape sugar. On evaporation, cream of tartar and sugar crystallize out. In East Indian Tamarinds citric acid is present in but small quantity. No peculiar principle to which the laxative action of Tamarinds can be attributed is known. The fruit pulp diffused in water forms a thick tremulous somewhat glutinous and turbid liquid owing to the presence of pectin. The testa of the seeds abounds in tannin, and after long boiling can be separated, leaving the cotyledons soft. The latter have a bland mucilaginous taste. Brannt states that the seeds contain 20 per cent. of a thickly fluid oil with an odour of linseed, and classes it with

the non-drying oils. By expression from the dry seeds we were unable to obtain any oil, and by solvents the yield was only 3·9 per cent. The oil possessed greater siccative properties than boiled linseed oil.

C. Mueller has examined nine samples of East Indian Tamarinds with the following results:—

Seeds.	Pulp free from seeds.					Dry pulp.	
	Water.	Insol.	Pot. Bitart.	Tart. acid.	Citric. acid	Pot. Bitart.	Tartaric acid.
Highest °/. 38·0	30·81	20·2	6·01	8·80	3·95	8 25	12·25
Lowest °/. 1·5	21·92	12·2	4·66	5·29	0·64	6·21	6·77
Average °/. 13·9	27·00	16·2	5·27	6·63	2·20	7·20	9·09

He found very small quantities of malic acid, which were calculated as citric acid.—(*Pharm. Centralhalle,* 1882, *Nos.* 49 *and* 50.)

Commerce.—Large quantities of Tamarinds are shipped to Persia and other northern countries. Some go to Europe, where they are used for pharmaceutical purposes. The red kind from Guzerat is most esteemed, and is worth Rs. 50 per kandy of 7 cwts. Some of the inferior kinds are not worth more than Rs. 20.

The pulp is prepared for the market by removing the seeds and epicarp by hand; the pulpy portion is then usually mixed with about 10 per cent. of salt and trodden into a mass with the naked feet; there are several qualities in the market, the chief difference being in the amount of care which has been taken in preparing them, the best is free from fibre and husk, the worst contains both as well as the seeds. Careful housekeepers prepare their own pulp, and expose it for a week to the sun and dew to ripen it.

Tamarind seeds are universally eaten by the natives; they are first roasted and soaked to remove the outer skin, then boiled or fried, when they become tolerably palatable. In the

raw state they are used by the poor as an astringent masticatory like betelnut. A size made from the seeds is used as a dressing to country-made blankets.

BAUHINIA VARIEGATA, *Linn.*

Fig.—*Rheede, Hort. Mal i., t.* 32.

Hab.—India. The bark.

Vernacular —Kachnár (*Hind.*), Kanchana (*Mar.*), Kánchan (*Beng.*), Kanchivala (*Can.*)

History, Uses, &c.—There are two varieties of this Bauhinia. The flowers of the one are purple, or deep rose-coloured, and of the other white, yellow and green; both are noticed in the Bhavaprakása under the names of Kovidara and Kanchanára, and are said to have similar properties, the bark being described as alterative, tonic, astringent and useful in scrofula, skin diseases, and ulcers. Chakradatta recommends the bark of the first variety in scrofulous enlargements of the cervical glands, and directs it to be given in emulsion with rice-water and ginger. Sárangadhara also recommends it for a similar purpose, and prescribes it in combination with guggulu (gum-resin of *Boswellia serrata*), myrobalans, and a number of aromatics. In the Concan the juice of the fresh bark with the juice of the flowers of *Strobilanthes citrata*, 10 tolás of each, is given as an expectorant, and the bark is used with ginger as an internal remedy for scrofula. Under the name Kachnár, the author of the Makhzan describes the bark as astringent, attenuant and tonic. He says it is used to check diarrhœa, to remove intestinal worms, and prevent the decomposition of the blood and humours; on this account it is useful in leprosy and scrofula. A gargle made from the bark with the addition of Akákiá (extract of Acacia pods) and Pomegranate flowers is mentioned as a remedy in salivation and sore throat, and a decoction of the buds in cough, bleeding piles, hæmaturia and menorrhagia.

Description.—The bark is grey, tolerably smooth, compact, fracture granular, reddish brown, the external surface is covered thickly with little elliptic warts of a darker colour than the rest of the bark, the internal surface is white. The taste is feebly astringent; microscopic examination discovers nothing characteristic.

The juice of the fresh leaves of **B. racemosa,** *Lam. Hook. Ic., t.* 141; *Bedd. Fl. Sylv., t.* 182, mixed with black pepper, is applied to the head in fever attended with headache. This tree is known by the Sanskrit names of Apata and Vana-raja, and its leaves are worshipped and distributed as gold at the Dasara festival. The bark is highly astringent, and is administered by the natives in chronic dysentery and diarrhœa. A dry extract made from it very closely resembles kino in appearance and properties; it occurs in purplish red fragments, soluble in water, and only partially in spirit. In Pudukota, where the tree is called Kattathi, the leaves with onions are given for diarrhœa. Several of the Bauhinias yield a partially soluble gum, which is known as Sem or Semla gum. The young buds of **Bauhinia tomentosa,** *Linn., Bot. Mag., t.* 5560; *Rheede Hort. Mal. i., t.* 35, Sampage (*Can.*), are said by Ainslie to be prescribed by native practitioners in Southern India in dysenteric affections; they are mildly astringent. According to Rheede, a decoction of the root-bark is administered on the Malabar Coast in cases in which the liver is inflamed.

Chemical composition.—The kino, prepared from the bark of *B. racemosa,* was practically soluble in water with a red colour, and afforded to ether one per cent. of crystalline pyrocatechin. About half the drug consists of tannic acid giving a dirty green precipitate with ferric salts; when thrown down by neutral lead acetate the precipitate holds 35 per cent. of PbO, and the basic salt 55 per cent. Shaken up in powder with rectified spirit, about 7 per cent. of extract was obtained answering to glucose; while by treating the filtrate from the lead compound with hydrogen sulphide and filtering, as much as 17 per cent. of glucose was separated. The large amount

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(13·3 per cent.) and causticity of the ash point to the fact that, different to other kinos, much of the tannic acid is in combination.

MIMOSA PUDICA, *Linn.*

Fig.—*Bot. Rep., t.* 544. Sensitive plant (*Eng.*), Sensitive commune (*Fr.*)

Hab.—Hotter parts of India, probably introduced from Tropical America.

Vernacular.—Lajálú (*Hind.*), Làjak (*Beng.*), Lájri (*Mar.*), Total-vadi (*Tam.*), Mudugudavare (*Can.*).

History, Uses, &c.—A native of Brazil long naturalized in India, and called in Sanskrit Khadiri and Anjalikarika, *i.e.*, joining the hands in worship or prayer. Mír Muhammad Husain states that it is much valued as a medicine by the Indians, and is considered to be resolvent, alterative, and useful in diseases arising from corrupted blood and bile. The juice is also applied externally to fistulous sores. He says that at the time of the *Pakhad Nakshatra*, the Indian Mahometans resort to the places where the plant grows, wash, and offer some sweets and burn incense; they then gather the plant, taking care that the shadow of the gatherer does not fall upon it, and dry it in the shade: when the moon is again in the same Nakshatra, they powder it and mix about four grains with cow's milk, and say the following *mantra* seven times before they take it :—

*بسم اللہ دولہا امرت دولہا سنکہ ا دان نمو نمو بشواد

The medicine is taken every day for three weeks in the same manner,—in the first week all bilious diseases and fevers are supposed to be cured, in the second piles, jaundice, &c., and in the third leprosy, scabs and pox.

* This *mantra* appears to be a farrago of Arabic, Persian and Sanskrit of doubtful meaning.

Ainslie, noticing its use in Southern India, says:—"A decoction of the root of this plant is considered on the Malabar Coast to be useful in gravellish complaints. The Vytians of the Coromandel side of India prescribe the leaves and root in cases of piles and fistula: the first are given in powder, in a little milk, to the quantity of two pagodas' weight or more during the day." (*Mat. Ind.* II., 432.) In the Concan the leaves are rubbed into a paste and applied to hydrocele; and their juice with an equal quantity of horse's urine is made into an *anjan* which is used to remove films of the conjunctiva by setting up an artificial inflammation. In what is called *cracked pot cough* by the natives, the root is directed to be gathered on Sunday, wrapped in Bhojpatra (bark of *Betula Bhojpatra*), and tied with a string made of silk of five different colours; this packet is to be kept in the sun and tied upon the patient's neck at ebb tide.

This is the commonest kind of sensitive plant, and is too well known to require description; it has an acid and pungent taste; the root is fibrous.

Theophrastus (H. P. IV. 3.) mentions a sensitive plant called *ὕλημα* with pinnate leaves and spinous branches of which he says *εαν τις ἁφηται των κλονιων, τα φυλλα, ωσπερ αφαναινομενα συμπιπται, ειτα μετα τινα χρονον αναβιωσκει και θαλλει.*

Chemical composition.—The tapering thin roots of *M. pudica* contain 10 per cent. of tannin of such a nature as to form a good black ink with salts of iron. The ash of the roots amounts to 5·5 per cent.

ENTADA SCANDENS, *Benth.*

Fig—*Scheff. in Nat. Tijdschr. Ned. Ind. xxxii.,* 99, *t.* 16—18; *Rheede, Hort. Mal. viii., t.* 32—34; *ix., t.* 77. *Syn.*—Entada pursætha.

Hab.—Cosmopolitan in the tropics. The seeds.

Vernacular.—Garambí, Gardul (*Mar.*), Gila-gach (*Beng.*), Parin-kaka-vully (*Mal.*), Suvali-amli (*Guz.*), Pangra (*Sikkim*), Takdokhyen (*Lepcha*); the seeds, Pilpápra (*Guz.*), Gila (*Beng.*).

Description, Uses, &c.—The plant is a gigantic climbing shrub, remarkable for its legumes, which are several feet long, 4 to 5 inches broad; and surrounded with a thick, very firm, polished entire rim, which is found to remain like a picture-frame when the less durable jointed body of the legume has disappeared. The joints are 10 to 30, one-seeded, ligneous, swelled in the centre, transversely furrowed, greenish ash-colour when ripe. The seeds are more or less heart-shaped, flattened, about 2 inches in diameter, with a shining brown testa, which is 1-16th of an inch thick, and very tough and horny. It encloses two large, equal cotyledons which adhere to it. The radicle is patelliform, and lodged at the umbilicus of the seed. The substance of the cotyledons is white and insipid. When a thin section is cut and a drop of water placed upon it, the water immediately becomes milky, and the opacity of the section is much diminished. Under the microscope this is seen to be due to the escape of oil globules and granular matter from their containing cells. The properties of the seeds do not appear to have been tested in European practice; among the natives they have the reputation of being emetic, and a paste prepared from them is applied to glandular swellings. Dalzell and Gibson (*Bombay Flora*, Part I., p. 84), say:—"An infusion of the spongy fibres of the trunk is used with advantage for various affections of the skin in the Philippines, where it is called 'Gogo' (Adams); the seeds are eaten roasted in Soonda." Horsfield in his list of Javanese plants states that this plant is used as an emetic by the Javanese, but he does not say which part of the plant is employed. Ainslie notices it under its Javanese name of Gandoo, and remarks that it is the Mahapus-woela of the Cingalese, and the Faba marina of Rumphius. The Lepchas and other hill tribes use the seeds as a soap to wash their hair, and as a food after they have been roasted and soaked in water.

Chemical composition.—The seeds have been examined by Moss (1887), who found 7·03 per. cent. of a neutral, turbid, pale yellow, viscid oil, which was not rendered clear by heat. (Brannt gives the yield at about 30 per cent.)

Alcohol extracted 4·6 of a reddish gummy hygroscopic extract; chloroform 0·435 of a pale yellow hygroscopic extract. Neither of these extracts yielded any alkaloid or glucoside, nor did a proof-spirit extract, or the extracts of the integuments, but an aqueous extract gave evidence of the presence of saponin. (*Pharm. Journ., Sept.* 17*th,* 1887.)

ACACIA, Several species.

Fig.—*Bentl. and Trim., t.* 94—95. Gum Arabic (*Eng.*), Gomme Arabique (*Fr.*). From African and Arabian acacias.

Vernacular.—Gum Arabic, Maswai-gond, Maklai-gond (*Bomb.*).

Extract of the pods, Ákákia (*Ind., Arab.*).

History, Uses, &c.—There appears to be no mention of gum Arabic in Sanskrit works. It was known from a very early date in Egypt as Kami. Dioscorides calls it κόμμι in his chapter περὶ ακακίας. Pliny mentions Gummi several times.* Arabic and Persian writers describe it under the name of Samgh-i-Arabi. The author of the Makhzan gives the following description of what it ought to be:—"The gum of the tree called Ammughilán or Mughilán (Acacia) of a yellowish white colour, shining, and perfectly soluble in water, forming a clear sticky solution." Gum is used medicinally by the Mahometans, who consider it to be pectoral, strengthening, and emollient. An account of the history of gum in Europe, and its production in Northern Africa will be found in the *Pharmacographia.* The gum Arabic of Bombay, known in European commerce as East India gum, is an imported article, and is brought from Aden and the Red Sea ports, no part of it being the produce of India. Two kinds are met with in that market, *viz.,* "*Maklai,*" in large round tears or vermicular pieces, white, yellow, or reddish, much like gum Senegal, but more fissured, (it derives its name from the port of Makalla), and "*Maswai,*" in angular fragments and vermicular pieces, fis-

* Plin. 13, 20; 24, 64, 67.

sured, white, yellow or reddish, which derives its name from the port of Massowa. Both of these are good soluble gums, and if carefully sorted not much inferior to Kordofan gum. Both are exported to Europe, and form the East Indian gum of commerce. About 15,000 cwts. of these gums were annually imported into Bombay, but since the war in the Soudan the imports have much decreased.

Akakia, according to the best Arabic and Persian authorities, is an extract prepared from the juice of the Karaz. This is the fruit of the *Acacia nilotica* of Delile (*Fl. Ægypt.*, *t.* 963), the *Acacia vera* of Vesling (*Œgypt.*, *p.* 9, *Icon.*), and is called by the Egyptians "Sant."

It is the ακανθος of Theophrastus (iii., 4; iv., 3; vi., 1) and the Acanthus of Virgil, who speaks of "baccas semper frondentis acanthi" in allusion to the globular inflorescence (Georg. ii., 119).

Pliny (24, 67) says that "the juice is left to thicken in the pods, which are steeped in rain water for the purpose, and then pounded in a mortar; after which the juice is extracted by means of presses. It is then dried in the sun, and when dry divided into tablets." It is considered to be cold and dry, astringent, styptic, and tonic, and is used internally and locally in relaxed conditions of the mucous membranes, also as a collyrium in purulent conjunctivitis and chronic congestion of the vessels of the conjunctiva. Applied as a lotion it is said to improve the complexion. With white of egg it is a good application to burns and scalds, powdered it arrests hæmorrhage; in short, it is used in all cases in which an astringent is indicated.

Description.—It is heavy, hard, and has an agreeable odour, small fragments held between the eye and the light should be of a bottle-green colour, but some samples have a reddish tinge like the glass of which hock-bottles are made; when seen in bulk it appears black. The taste is sweet, astringent and mucilaginous. Placed in cold water it soon disintegrates, forming a mucilage in which floats a quantity

of olive-green or brownish-green matter; after filtration the mucilage is similar in colour to that of gum arabic.

Commerce.—Akákia is imported from the Red Sea ports, and is kept by all Mahometan druggists; it occurs in bladders containing 5 to 6 ounces each.

Chemical composition of Gum.—The lævorotatory gums are principally potassium, magnesium, and calcium salts of arabic or allied acids; they contain from 12 to 18 per cent. water, and yield 2·7 to 3·0 per cent. of ash consisting almost wholly of carbonates of these metals. Arabic acids ($C^{12} H^{22} O^{11}$) has been isolated from the so-called East Indian gum. (*O'Sullivan.*) For the method of preparing it see (*Watt's Dict. of Chem. by Morley and Muir*, ii., 295.) When slowly dried out of syrupy solutions, on glass plates, it is a brittle, transparent, colourless, glassy body, soluble in water. During desiccation, especially if a little mineral acid be present, the acid is frequently converted into the meta modification. Solutions of arabic acid are strongly acid to litmus paper, and have a sharp acid taste; they completely neutralise solutions of the alkalies and alkaline earths, and decompose carbonates. The salts of the alkaline earths are precipitated out of solution by alcohol; those of the alkalies are not precipitated under the same conditions, but yield peculiar milky or opalescent solutions from which arabic acid, with some of the alkaline salt, is precipitated on the addition of stronger acids. $Ba SO^4$, PbS, and other sulphides, and some hydrates precipitated in solutions of arabic acid, cannot be filtered out, but pass, in greater part, through the filter. Gum arabic prevents the precipitation of the alkaloids by phosphomolybdic acid, potassium-mercury iodide and tannin. (*Lefort et Thibault.*) These are properties common to all the gum acids. The defining characters of arabic acid are its optical activity, *viz.* $[\alpha] j = -26°$ to $28°$, for solutions containing 5 to 6 grams dry substance in 100 c.c., and the composition of its neutral barium and calcium salts; in the dry state, the former contains 6·0 per cent. BaO and the latter 2·28 per cent. of CaO. (*O'Sullivan.*) Solid gum roasted with oxalic acid

yields metagummic acid (*Frémy*); this is dissolved by solutions of the alkalies and alkaline earths with the reproduction of arabic acid. (*Rhem. in Ding. Pol. Journ.* 216, 539.) Gum even in small quantities injected into the blood diminishes the elimination of urine; large doses completely stop the secretion, with a marked increase of blood pressure (*Richet et Montard-Martin, Compt. Rend.* 90, 88.) Gums vary much in the character of the solutions they yield, some give a thin syrupy solution, others a thick and jelly-like one; this is due to the varying proportion of the acid naturally converted into the meta modification—the gums which yield the thinnest solution are those which contain the greatest amount of ash. Gums from the same source have not always the same optical activity. (*Watt's Dict. of Ch. by Morley and Muir*, ii., 296.)

SUBSTITUTES FOR GUM ACACIA.

We are indebted to Mr. J. G. Prebble of Bombay for the following:—

The exports of Indian gums for use as substitutes for gum arabic, have during the last few years obtained considerable proportions, and there is every probability of a steady increase due to the improvements in communication between the ports and the interior of the country, and the supplies promise to rival in the near future the large exports of gum from Senegambia. The gums here described include the majority and the most important of those known to be yielded by Indian trees; and most of them have been personally collected by the writer; a few have been kindly forwarded by Mr. Duthie of Saharanpur and some by Mr. Cameron of the Lal Bagh, Bangalore. Nearly all the gums have been examined under the microscope, and in connection with this subject some account should perhaps be given of the recent interesting researches of Beijerinck and Wiesner. All gums were formerly supposed to be the dried mucilaginous sap secreted by a natural or physiological process in the life of the plants yielding them. It was first clearly shown by Mohl, that, in the case of tragacanth, the gum is produced by a metamorphosis of the cell membrane,

and that it is not merely the dried secretions of the plant. The investigations of other observers also demonstrated that cherry and some other gums were formed by a similar process, but no information was obtained of the causes which led to these metamorphoses. The observations of Beijerinck and of Wiesner, however, point to the conclusion that in at least several instances gum is formed by a pathological process brought about by the influence of a fungus, or of a peculiar ferment allied to diastase and termed by Wiesner a "diastatic enzyme," but differing from the ordinary members of the group in that, whilst it converts starch into dextrine, it produces no sugar reducing Trommer's reagent. The diastatic character of the gum was inferred from its behaviour in limiting or preventing the iodine reaction on starch dough. Beijerinck found that by inserting a portion of gum under the edge of a wound in the bark, the formation of gum was induced. The observation that heated or long boiled pieces of gum would not produce this effect, and that wounds made in the bark did not produce gum unless a portion was first introduced into it, led him to suppose that the formation of gum was due to the presence of bacteria or other living organisms. On microscopical investigation it was found that only those pieces of gum that contained spores of a highly organised fungus belonging to the Ascomycetes, had the power of conveying the gum disease or gummosis. The fungus producing the gummosis of species of acacia of Africa has been named *Pleospora gummipara,* Oudemans. Another fungus, *Coryneum Beijerinckii* causes the gummosis of the Amygdalæ. Beijerinck believes that the fungus produces a fluid of the nature of a ferment, which penetrates the adjacent structures, since the disease extends beyond the parts in which any trace of the fungus can be detected. This ferment he believes to act on the cell walls, starch granules, and other constituents of the cells, transforming them into gum, and* even changing into gum the fungus itself. In all the gums examined by the writer, fungus spores were observed, and in many cases gonidial forms and

* *Pharm. Journ.*, 3-14-661 and 3-16-285.

hyphæ. These gonidial forms and hyphæ vary considerably in the same genera. The hyphæ and gonidia found in the gum of *Acacia modesta* from the Punjab differ in shape and size from the same forms observed in *Acacia Farnesiana* from Bombay, and the forms occasionally met with in *Acacia arabica* differ from both. It seems therefore improbable that only one species of fungus produces the gummosis in the tribe acacia as stated by the above observers. That gum has the power of converting starch into dextrine, is readily proved by its action on starch paste, but the statement of Wiesner that whilst it converts starch into dextrine, it produces no sugar reducing Trommer's reagent, I am unable to confirm. In several experiments performed with different gums, a reducing sugar was in every instance abundantly produced, and it is probable that the action of gum on starch is similar to that of diastase, when the hydration products are dextrine and maltose, the proportions of which vary according to the conditions of the experiment, especially as regards the temperature employed. With the aid of iodine the gradations in the transformation or hydration of the starch may be easily followed. When the gum and starch paste has been standing a short time, iodine gives a blue or violet coloration, after a longer period some shade of crimson, the erythrodextrine of Gruber, and finally the mixture ceases to give any reaction when the conversion of the starch is then complete. Gum which is permeated with fungus, as that derived from *Acacia Farnesiana,* has a more rapid action on the starch paste than a gum free or nearly so from fungus as that from *Anogeissus latifolia.* *Acacia Farnesiana* gum will convert its own weight of starch, made into paste, in two or three days at the ordinary temperature of Bombay, about 80° F. At a higher temperature the transformation is quicker.

With regard to the behaviour of gums to reagents, too much reliance must not be placed upon the reactions, as gums from the same tree often give different results. It is believed, however, that they will often furnish useful indications of the source of a gum, taken in conjunction with their physical and

sometimes microscopical characters. The reagents employed are those which have been found most useful for comparative purposes. All the gums, with the exception of the paler samples of *Acacia arabica*, and a gum said to be yielded by *Acacia leucophlœa*, are gelatinized by basic acetate of lead.

Gums or so-called gums from the following plants have been examined:—

Feronia Elephantum.—The gum occurs in small, irregular or rounded tears, varying in colour from reddish brown to pale yellow or colourless. The paler samples dissolved in water form a thick, tasteless and colourless mucilage. The solution is precipitated by both neutral and basic acetate of lead and by ferric chloride, but not by borax. This is one of the most valuable of the Indian gums, and is a good substitute for gum arabic.

Ægle Marmelos.—A small sample of this gum received from Saharanpur was in reddish brown, transparent angular fragments. It is quite insoluble in water, but dissolves in strong alcohol; it is therefore a resin. A small quantity of exudation collected from a tree in Bombay was also a resin. The solution in alcohol is of a yellow colour with a greenish fluorescence.

Melia Azadirachta.—The gum occurs in large tears, cracked and fissured on the surface, or in vermiform or stalactiform pieces of a pale yellow or amber colour, readily dissolving in water, forming a good, pale-coloured mucilage. The solution is gelatinized by ferric chloride and basic acetate of lead, but not by borax or neutral acetate of lead.

Cedrela Toona.—Some gum gathered from a tree on the Nilgiris was in transparent stalactiform masses of a yellowish brown colour, and smooth and polished on the surface. It forms a thick mucilage with a large volume of water. The mucilage is gelatinized by basic acetate of lead, but is unaffected by the neutral acetate, ferric chloride or borax. After keeping the gum about a year and again treating with water it

was found to be much less soluble, the gum swelling into a gelatinous mass.

Swietenia Mahagoni yields a gum that often runs down the side of the tree, drying up into brittle, white, shining fragments, which however become yellow on keeping. It dissolves readily in water, forming a weak dark-coloured mucilage, which freely reduces Fehling's solution; is precipitated by acetate of lead, gelatinized by the basic acetate and by ferric chloride, but not by borax.

Chloroxylon Swietenia.—A sample of this gum received from Bangalore was in dark reddish-brown tears and stalactiform pieces. It swelled up in water, forming a gelatinous mass, hardly any dissolving.*

Anacardium occidentale yields large quantities of gum, mostly in stalactiform masses, varying in colour from yellow to deep reddish brown. It dissolves readily in water, but forms a slightly glairy, more or less turbid mucilage. The turbidity is due to the presence of a small quantity of a yellowish oily body, which may be detected under the microscope. It is probably the occurrence of this oil in the gum that renders it obnoxious to insects. A mucilage of the yellowish gum is unaffected by neutral acetate of lead, perchloride of iron, bichromate of potash, molybdate of ammonia or borax, but it very freely reduces Fehling's solution, and is gelatinized by basic acetate of lead. The mucilage of the dark reddish brown gum is blackened by bichromate of potash and by ferric chloride, but is not gelatinized. It is precipitated by molybdate of ammonia.

Odina Wodier yields an abundant supply of gum in large tears and stalactiform masses, of white, yellow or amber colour; brittle and friable from the presence of numerous minute cracks. With water it forms a glairy mucilage, which is turbid from the presence of a small quantity of oil recogniz-

* A sample from another source was more soluble (see p. 339), but the solution had scarcely any adhesive power.

able under the microscope. The mucilage slightly reduces Fehling's solution, is gelatinized by basic acetate of lead and ferric chloride, but not by neutral acetate of lead nor by borax.

Spondias mangifera.—The gum exudes in stalactiform pieces of a yellowish or reddish-brown colour and with a smooth shining surface. It forms a gelatinous mucilage with a large volume of water. The mucilage is precipitated by acetate of lead, gelatinized by the basic acetate and by ferric chloride, but not by borax.

Poinciana regia yields a gum in irregular granular or warty tears of a yellowish or reddish brown colour soluble in water, forming a thick opalescent mucilage. The solution is gelatinized by basic acetate of lead and ferric chloride, but not by the neutral acetate nor by borax. Fehling's solution is slightly reduced. The gum contains a large quantity of oxalate of lime. The surface of some of the tears is of an opaque yellow colour; this portion consists largely of beautiful sphæro-crystals of oxalate of lime, closely resembling in formation the sphæro-crystals of inulin. On moistening this gum with water a cloud of small crystals often separates, and the sphæro-crystals attempt to arrange themselves into bundles of acicular crystals.

Bauhinia purpurea yields an inferior gum that swells up in water, forming a gelatinous mass, very little dissolving.

Bauhinia variegata.—A sample of the gum received from Bangalore was in irregular broken tears of an amber colour, but distinctly opalescent. It is not completely soluble in water, but forms a milky mucilage due to the presence of starch. Examined under the microscope the starch is seen to be composed of round granules, some of which are fused together into masses. Many of the granules do not give a well-defined cross with polarized light, and appear to be worn and degraded. Three-celled cask-shaped gonidia with a hyaline extremity, and sphæro-crystals of oxalate of lime are also met with.

Prosopis spicigera.—The gum, which is unusually friable, occurs in small angular fragments of a yellowish colour, more or less deep, sometimes in large ovoid tears about two inches long, of an amber colour internally, but having a frosted or candied appearance externally from the presence of numerous minute cracks which cause the tears to crumble under pressure. With water it forms a rather dark coloured tasteless mucilage of about the same viscosity as gum arabic. The solution is precipitated by the normal acetate of lead and gelatinized by the basic acetate, also by ferric chloride, borax and alkaline silicates. It rather freely reduces Fehling's solution. This is a valuable gum, and appears to resemble, except in its behaviour to reagents, the Mezquite gum of Mexico and Texas, which is now coming into use in America.

Acacia Farnesiana yields gum freely in the form of spheroidal tears and stalactiform masses ranging in colour from pale yellow to dark-reddish brown. The gum collected in the neighbourhood of Bombay and at Poona in the Deccan is only slightly soluble. On stirring up with water it partially dissolves, but after remaining a short time undisturbed it gelatinizes. The strained mucilage is precipitated or gelatinized by neutral and basic acetate of lead, perchloride of iron, and silicate of soda, but not by borax. It slightly reduces Fehling's solution.

Under a high power of the microscope, the gum is seen to be thickly interwoven with the minute hyphæ and fructifications of a fungus probably belonging to the Ascomycetes. The fungus is composed of a brown parenchyma containing oil globules, and bearing oval-shaped gonidia divided into two cells by a transverse septum. The gonidia are supported on hyaline stems (sterigmata) arising from the hyphæ. *Debris* of cells containing monoclinic crystals and interwoven with fungi are occasionally met with.

Acacia arabica yields an abundant supply of gum, mostly exuding in the hot weather. It forms tears and stalactiform masses, the latter sometime of large size when ob-

tained from trees that have been wounded. The colour varies from pale yellow to deep reddish brown or black. It is usually quite soluble in water, forming rather a weak mucilage. The solution is not gelatinized by either neutral or basic acetate of lead, but it slightly reduces Fehling's solution, and is darkened in colour by ferric chloride and gelatinized by borax. The deep reddish brown or black gum which has hung long on the tree contains tannin, and is precipitated by basic acetate of lead; forms an inky colouration with ferric chloride; a deep brown with bichromate of potash, and a red with molybdate of ammonia. It freely reduces Fehling's solution. This dark-coloured gum is not always readily soluble in water, but leaves a gelatinous portion undissolved. In connection with the solubility of this gum, the observations of J. H. Maiden* on the *Eucalyptus Kinos* are of interest. He found that the kino when freshly gathered is quite soluble, but that by exposure on the tree to sun and air the gum becomes black and insoluble. This he regards as due to the conversion of the tannin into phlobaphenes, and in those that contain arabin the tendency to insolubility is probably enhanced by the partial conversion of that substance into metarabin. The gum is usually free from fungus, but I have met with three-celled, somewhat cask-shaped gonidia, with a small hyaline portion at one end, the remains of the stem.

Large quantities of this gum, collected chiefly in the Behars and Central Provinces, are exported from Bombay. It forms the bulk of the Amrad,† Amraoti or Oomrawatti gum of the Bombay gum merchants.

Acacia leucophlæa—A sample of this gum received from Bangalore was readily soluble in water, forming a good,

* Botany Bay, or Eucalyptus Kino; by J. H. Maiden, *Pharm. Journ.*, [3], XX., p. 221.

† This word Amrad is probably a corruption of the Arabic hamrâ, red, and is a name applied to all dark-coloured gums. The word appears to have been first used in connection with African gums. The Acacia arabica trees in Senegal are called Red gum trees; see also *Pharm. Journ.*, 3-19-1.

thick, pale-coloured mucilage. The solution is gelatinized by borax, but is unaffected by either neutral or basic acetate of lead or perchloride of iron.

Acacia Catechu.—The gum occurs mostly in spheroidal tears of a yellow or brown colour, freely soluble in water, forming a thick pale-coloured mucilage not precipitated by neutral acetate of lead, but gelatinized by basic acetate of lead, ferric chloride, and borax. It freely reduces Fehling's solution.

Acacia modesta.—The gum occurs mostly in very small tears or angular fragments with some vermiform pieces marked with waved transverse lines. It is translucent and of a yellowish colour; very soluble in water, forming a good pale-coloured mucilage. With basic acetate of lead and ferric chloride it forms a jelly, but not with borax; with neutral acetate of lead a faint precipitate or cloudiness, and a slight reduction with Fehling's solution. The gum is sent to Bombay from Northern India, and is classed by the gum merchants as Amritsar gum.

Albizzia procera.—The trunks of trees growing in the neighbourhood of Bombay are often covered with numerous granular or warty masses of gum about half an inch in diameter; occasionally the gum exudes in small tears and vermiform pieces. It is of a reddish brown colour, transparent and polished in appearance when fresh, but becomes dark and opaque on keeping. The freshly exuded gum completely dissolves, yielding a thick, slightly gelatinous mucilage, but the dark, opaque gum is imperfectly soluble. The mucilage is gelatinized by both neutral and basic acetate of lead and by ferric-chloride, but not by borax. It rather freely reduces Fehling's solution. The gum is permeated with the hyphæ of a fungus, and often contains *debris* of cells interwoven with hyphæ. Sphæro-crystals of calcium oxalate are frequently met with.

Albizzia stipulata yields a tough, dark-coloured gum, which swells up in water into cartilage-like masses, very little

dissolving. The soluble portion freely reduces Fehling's solution, is gelatinized by basic acetate of lead, but not by the neutral acetate nor by borax; with ferric chloride it darkens in colour, but is not gelatinized.

Albizzia Lebbek.—The gum exudes mostly in stalactiform masses and varies in colour from light to deep reddish brown. It is translucent and has a smooth polished surface. It forms a slightly gelatinous mucilage with a large volume of water; sometimes it is imperfectly soluble, and leaves a gelatinous portion undissolved. The mucilage is gelatinized by basic acetate of lead and by ferric chloride, but not by the neutral acetate of lead nor by borax. It slightly reduces Fehling's solution.

Albizzia odoratissima.—The gum forms large transparent tears of an amber colour; free from cracks internally, but superficially fissured. In water it swells up into tough colourless masses, very little dissolving.

Pithecolobium dulce yields a gum usually in spheroidal tears, about half an inch in diameter, of a deep reddish brown colour, transparent, and with a polished surface. It is freely soluble in water, forming a thick brown mucilage. The solution is unaffected by neutral acetate of lead, but is gelatinized by the basic acetate, ferric chloride, and borax. It freely reduces Fehling's solution.

Pithecolobium Saman yields a very inferior gum, forming irregular tears and vermicular pieces with waved transverse ridges. It is of a soft and tough consistence, and swells up in water into tough cartilage-like masses. On keeping, it turns a deep reddish brown or black colour.

Anogeissus latifolia.—The gum usually occurs in rounded or vermicular pieces, sometimes in elongated tears. Colour ranging from amber-brown to pale yellow or colourless; the surface is roughened and opaque; it has a glassy fracture, and is quite transparent internally and free from cracks. The gum

darkens in colour by keeping through the monsoon season, and becomes agglutinated into masses. With water it forms a nearly colourless mucilage, quite colourless with the finer qualities of the gum, possessing a faint characteristic odour, and about double the viscosity of gum arabic treated with the same proportion of water. The solution is gelatinized by basic acetate of lead and by borax, but is unaffected by ferric chloride or neutral acetate of lead. This is a very valuable gum, and may be obtained in almost any quantity nearly free from admixture with other gums, as it possesses well marked physical characters which render it readily distinguishable. Its dull white, roughened surface and glassy fracture free from cracks distinguish it from all other gums. The finer qualities are well suited for use in pharmacy, and for the preparation of emulsions it is unrivalled. As it possesses about double the viscosity of gum arabic, one part of this gum should be used where two parts of the former are ordered.

This gum is now largely exported, and forms the bulk of the Ghátí * gum of the Bombay gum merchants.

Terminalia belerica produces a gum in tears and vermicular pieces of a dark brown colour with a smooth surface, free from cracks. When placed in water it swells up to a tough gelatinous mass, very little dissolving. The gum contains crystals of calcium oxalate in dumb-bell-like forms, sphæro-crystals and groups of fine crystalline particles.

Aleurites moluccana yields in Bombay a partially soluble gum of a yellowish or brown colour. The solution is gelatinized by neutral and basic acetate of lead and by borax but not by ferric chloride. The gum is permeated with the hyphæ of a fungus.

* The Marathi adjective Ghátí signifies "relating to the Desh or country above the Sayhadri range."

Tabular View of the Solubility and Reactions of Indian Gums.

A—*Arabic-like gums soluble in water.*

	Neutral Acetate of Lead.	Ferric Chloride.	Borax.
Acacia arabica	....	....	Gelatinized.
„ leucophlœa (?)......	....	....	Gelatinized.
Anogeissus latifolia	....	....	Gelatinized.
Acacia modesta	Precipitated.	Gelatinized.	....
Feronia Elephantum	Precipitated.	Gelatinized.	....
Swietenia Mahogani	Precipitated.	Gelatinized.	....
Acacia Catechu	....	Gelatinized.	Gelatinized.
Pithecolobium dulce	....	Gelatinized.	Gelatinized.
Melia Azadirachta	....	Gelatinized.	....
Prosopis spicigera	Precipitated.	Gelatinized.	Gelatinized.

B—*Gums readily dissolving in water but forming a more or less turbid mucilage from insoluble suspended substances.*

	Acetate of Lead.	Ferric Chloride.	Suspended substance.
Anacardium occidentale.	....	....	A yellowish oil.
Odina Wodier......	....	Gelatinized.	A yellowish oil.
Bauhinia variegata	Precipitated.	Gelatinized.	Starch granules.
Poinciana regia	....	Gelatinized.	Calcium oxalate in sphæro-crystals.

None of these Gums are gelatinized by Borax.

C—*Gums incompetely soluble and forming a more or less gelatinous mucilage with a large volume of water.*

	Neutral Acetate of lead.	Ferric Chloride.	Borax.
Cedrela Toona	....	....	....
Albizzia Lebbek............	....	Gelatinized.	....
Acacia Farnesiana	....	Gelatinized.	....
Albizzia procera............	....	Gelatinized.	....
Spondias mangifera	Precipitated.	Gelatinized.	....
Aleurites moluccana	Gelatinized.	....	Gelatinized.

D—*Gums swelling up into a gelatinous mass, very little dissolving.*

Albizzia odoratissima.
Albizzia stipulata.
Bauhinia purpurea.
Terminalia belerica.
Chloroxylon Swietenia.

Commerce.—Indian gums are almost entirely exported from Bombay. The exports and value for the last three years of gums of Indian production, not including those imported from African and other ports, were as follows:—

1886 and 1887.	1887 and 1888.	1888 and 1889.
Cwt...... 20,895	Cwt...... 31,826	Cwt...... 55,192
Rs. 7,93,934	Rs. 14,13,511	Rs......24,05,131

ACACIA ARABICA, *Willd.*

Fig.—*Roxb. Cor. Pl.*, *t.* 149; *Bedd. Fl. Sylv.*, *t.* 47. Babool tree (*Eng.*), Acacia d'Arabie (*Fr.*).

Hab.—India, Arabia, Africa. The bark.

Vernacular.—Bábul, Kikar (*Hind.*), Kuruveylam (*Tam.*), Bábhúl (*Mar.*), Bábul (*Beng.*), Baval (*Guz.*), Karijali (*Can.*).

Description, Uses, &c.—This tree is the Vabbula of Sanskrit writers, who mention the use of the young leaves and pods as an astringent in diarrhœa, and of a decoction of the bark as an astringent lotion. The bark is powerfully astringent, and as a substitute for Oak bark it is used in the Government hospitals and dispensaries in India. Externally a strong decoction of it is a useful astringent application to ulcers. The gum has already been noticed in the article upon substitutes for gum arabic. Babul bark is hard and woody, of a rusty brown colour, having a tendency to divide into several layers. The external surface is rugged and fissured longitudinally, the internal smooth and fibrous; taste astringent and mucilaginous.

The astringent bark of this and several other species of Acacia* is used in India to assist in the preparation of spirit from sugar and palm juice by precipitating the albuminous substances in the liquor and facilitating fermentation. Spirit thus prepared is noticed by Ainslie as the *Puttay chárágum* or bark spirit of the Tamils.

Chemical composition.—Kay and Baston (*Journ. Soc. Dyers and Col.* iii., 132) by employing Proctor's modification of Lowenthal's process for estimation of tannin, found 22·44 per cent. in the pods, expressed in terms of oxalic acid. (*Allen.*) The wood contains chlorides which act upon copper when burnt, and is therefore not adapted for fuel for engines on railways.

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* *A. leucophlæa*, *A. ferruginea*, *A. Jacquemontii.*

ACACIA CATECHU, *Willd.*

Fig.—*Roxb. Cor. Pl.*, *t.* 175; *Bentl. and Trim.*, *t.* 95. Catechu tree (*Eng.*), Acacia Cachou (*Fr.*).

Hab.—India. Acacia Catechu or Cutch.

Vernacular.—Khair (*Hind., Mar., Beng.*), Vodalia, Vodalam (*Tam.*), Khera-baval (*Guz.*), Kagli (*Can.*).

Catechu.—Katha, Kath (*Hind., Mar.*), Kattakambu (*Tam.*), Katho (*Guz.*).

History, Uses, &c.—Sanskrit writers under the name of Khadira mention two kinds of catechu, dark and pale, both prepared from the wood of the *Acacia Catechu*, and these two kinds are still to be found in common use. The dark acacia catechu is in flat cakes of a dark brown colour and shining fracture, or in square cakes known as box catechu. The light catechu is a porous earthy-looking substance, somewhat laminated and much more friable than the dark: it is used for chewing with betel leaves and areca nut, while the use of the dark kind is confined to industrial purposes. Dark catechu is made by evaporating a decoction of the wood until it becomes solid; in making the light kind the inspissation is stopped at a certain point, and the catechu is obtained as a deposit upon twigs which are placed in the liquid extract. The Hindus consider catechu to be astringent, cooling, and digestive, useful in relaxed conditions of the throat, mouth and gums, also in cough and diarrhœa. Externally they use it as an astringent and cooling application to ulcers, boils, and eruptions on the skin. A number of compound formulæ for its administration will be found in Chakradatta, Sarangadhara, and the Baisajya Ratnávali. Mahometan writers describe dark and light catechu, and their use in medicine for the purposes already mentioned. An account of the introduction of catechu into Europe will be found in the *Pharmacographia.* Other kinds of the drug which are imported into India by sea will be found described in the article upon Gambier. The gum of *A. Catechu* has been noticed in the article upon *Substi-*

tutes for gum arabic. In the Concans the juice of the fresh bark is given with Asafœtida in hæmoptysis, and the flowering tops with cummin, milk and sugar in gonorrhœa.

Chemical composition.—In addition to a large proportion, 45—55 per cent. of a variety of tannin (catechu tannic acid), cutch contains 30 to 40 per cent. of catechu, which is deposited on cooling a boiling aqueous solution. Cutch should not yield more than 5 per cent. of ash. (*Allen.*)

Catechu, $C^{19}H^{18}O^{8}$, is a name given to various compounds contained in catechu or Terra Japonica, which is extracted by boiling water from the fruits or twigs of a variety of plants; catechu from twigs and unripe pods of *Acacia* (*or Mimosa Catechu*); Gambier catechu from *Nauclea* (or *Uncaria*) *Gambier*; and Indian catechu from some Acacia.

Catechu tannic acid has the formula $C^{21}H^{18}O^{8}$ or $C^{38}H^{34}O^{15}$ (?), and may be extracted from catechu by water: it is also formed when catechin is alone heated to 130° C., or with water to 110° C., or by boiling with alkalies. It occurs as a dark reddish brown powder, which oxidises in air. It gives a greyish green precipitate with ferric chloride, and does not precipitate tartar emetic. Its aqueous solution is precipitated by gelatine, albumen and dilute sulphuric acid. (*Watt's Dict. Chem., Morley and Muir's edition.*) For further particulars the reader is referred to the *Pharmacographia*; and for tests of purity, &c., to Allen's *Commercial Organic Analysis,* Vol III., Part I.

Commerce.—Acacia catechu for use with pán-supári is largely prepared about Surat. Value, Rs. 20 per maund of 37½ lbs. Cutch fetches from Rs. 4 to 5 per maund, and is prepared in many parts of India by wild forest tribes.

KHERSAL OR KHAIRSAR.—From the wood of *Acacia Catechu* is obtained a substance which we have not seen any notice of in works on Indian Materia Medica. Khersal, or *natural catechu,* is obtained from cavities in the wood, and occurs in small irregular fragments like little bits of very pale catechu mixed with chips of reddish wood. This drug is collected by men who split firewood, and fetches a high price, as it is only

occasionally met with; it has a sweetish astringent taste, and under the microscope is seen to be composed of minute needle-shaped crystals. When placed in water the colouring matter of the particles of wood mixed with the drug colour the water red, but the khersál remains undissolved; in boiling water it is completely soluble, but is thrown down in conglomerate masses of small needle-shaped crystals upon the water cooling; it is also soluble in rectified spirit, and is deposited in the same form on the spirit evaporating. In native practice this substance is valued as a remedy in relaxed conditions of the throat.

A similar substance has been brought to our notice by the Conservator of Forests for Malabar. It is a yellow crystalline deposit found in the wood of the Poon spar (*Callophyllum tomentosum*).

KATHBOL—Is a mixture of catechu and myrrh, which is frequently given to women after confinement as a tonic, and to promote the secretion of milk.

ACACIA PENNATA, *Willd.*

Fig.—*Bot. Mag.*, *t.* 3408.

Hab.—India. The bark.

Vernacular—Shemb (*Mar.*), Biswúl (*Hind.*), Arar (*Can.*).

Description, Uses, &c.—A scandent shrub; prickles scattered, numerous, straight, or at length recurved; pinnæ 8 to 20 pair; leaflets beyond 30 pair, narrow linear, glabrous; heads of flowers globose-panicled; legume glabrous, or reddish with fine tomentum. The bark is an article of commerce, being used to tan fishing nets at Bombay; it occurs in strips about 3 feet long. In the Concan the leaf-juice mixed with milk is given to infants who suffer from indigestion with green stools. In bleeding from the gums the leaves are chewed with cummin and sugar; they are also rubbed to a pulp and mixed with cow's milk, cummin and sugar as a remedy for scalding of the urine. The dose is 2 tolás.

Chemical composition.—The bark afforded 14·2 per cent. of aqueous extract containing 8·8 per cent. of tannin. The

tannin gave a black precipitate with ferric chloride, and its lead salt contained one-third of its weight of oxide of lead. The powdered bark left 12·1 per cent. of ash on ignition.

Commerce.—The bark is collected in the Concan and exported to Bombay, where it fetches about Rs. 14 per 100 bundles of 7 lbs. each.

ACACIA CONCINNA, *DC.*

Hab.—India, Burmah. The pods.

Vernacular.—Sikekai, Shika (*Mar., Tam.*), Kochai, Ban-ritha (*Beng.*), Aila, Rassaul (*Hind.*), Chikaya, Gogu (*Tel.*), Sigé (*Can.*).

History, Uses, &c.—The tree is called in Sanskrit Saptala and Charma-kasa, or "skin-injurer," on account of its numerous thorns, and is common in many parts of the country. Ainslie has the following notice of the medicinal use of the pods in Southern India:—"Sheeakai is the name given by the Tamools to a long flat pod, or legume, containing separate, small, oval, dark-coloured seeds, and which is considered by the native practitioners as a most valuable medicine; in taste it somewhat resembles the soap-nut, but is more acid, less bitter, and has a singular pungency; its qualities are allowed to be deobstruent and detergent, and, I am inclined to think, expectorant; it is commonly ordered in cases of jaundice and other biliary derangements, and is besides used by the Indians like soap-nut for washing the head. The small leaves of the prickly shrub have a pleasant acidity, and are frequently put into pepper-water when it is found necessary to keep the bowels open or work off bile. The pod is usually prescribed in electuary in doses of about the size of a small walnut, every morning for three successive days." Nimmo notices the use of the pods by Hindus for making sectarial marks on the forehead. The leaves are used as an acid ingredient in food instead of tamarinds, and the bark is used in tanning.

Description.—Pod strap-shaped, straight, 3 to 4 in. by ¾ in., 6 to 10 seeded, with broad sutures, narrowed to a short

stalk, depressed between the seeds. In the Himalayan var. *rugata* the pod is larger, 1 to 1¼ in. broad.

Chemical composition.—The pods freed from their seeds, dried without artificial heat, and powdered, had the following percentage composition:—Moisture 8·44, saponin 11·20, malic acid 12·74, resin 1·06, glucose 13·88, gum and colouring matter precipitated by subacetate of lead 21·43, substances dissolved by alkali 4·97, crude fibre 22·52, ash 3·76. In estimating the saponin by the barium hydrate method, the malic acid was precipitated with it. The total free and combined acid was estimated by precipitation with neutral plumbic acetate, the malate of lead yielding fine white crystals in a few hours. Malic acid existed in the fruits in a free state. The total free acidity found by titration with standard alkali was equivalent to 4·48 per cent. of Na HO. The saponin could be very readily estimated by boiling an infusion acidulated with sulphuric acid for two hours, and by separating and weighing the insoluble sapogenin.

Commerce.—The pods are sold in the bazars of many parts of India. Value, Re. 1¼ to 1¾ per maund of 37½ lbs. They are collected largely by the Forest Department in South Canara. In 1885-86, 9 tons collected realized Rs. 555; in 1886-87, 135 tons realized Rs. 8,369; and in 1887-88, 97 tons realized Rs. 7,168.

ALBIZZIA LEBBEK, *Benth.*

Fig.—*Jacq. Ic. t.* 198; *Bedd. Fl. Sylv. t.* 53. The Siris tree (*Eng.*).

Hab.—Throughout India. The bark, leaves, and flowers.

ALBIZZIA ODORATISSIMA, *Benth.*

Fig.—*Roxb. Cor. Pl. t.* 120; *Bedd. Fl. Sylv. t.* 54.

Hab.—Throughout India.

Vernacular.—Siris (*Hind., Beng.*), Siras, Chichola, Chichva (*Mar.*), Sirasala-mara, Bengha (*Can.*), Vaghe (*Tam.*), Darshana (*Tel.*), Siris, Harreri (*Guz.*).

History, Uses, &c.—Both trees are known to the natives of India by the same vernacular names, and both are called in Sanskrit Sirisa and Kapitana, and bear the synonyms of Suka-pushpa, Suka-druma, and Suka-priya, "dear to parrots," and Mridu-pushpa, "having soft flowers." According to the Nighantas Siris has cold, tonic, and alterative properties. The author of the *Makhzan-el-adwiya* gives a detailed description of the two trees as varieties of one and the same plant, and says that he has been given to understand that the Arabs have named the tree Sultán-el-ashjár, and that the Persians call it Darakht-i-Zakariya. He states that the juice of the leaves is applied to the eyes to cure night-blindness, a decoction being at the same time given internally. A decoction of the bark is used as a mouth-wash to strengthen the gums. One masha of the powdered bark with three or four tolas of melted butter taken daily is an excellent tonic and alterative. A water is also distilled from the bark which is used for the same purposes. The flowers are supposed to be retentive of the seminal fluid. One dirhem of the powdered seeds with two dirhems of sugar-candy in a glass of warm milk taken daily is said to thicken the seminal fluid. A paste made with the seeds is applied to reduce enlarged cervical glands. The seeds are also used in the preparation of collyria. According to Baden-Powell, Stewart, and Madden **A. Julibrissin** has similar properties. In Madras the bark of *A. Lebbek* is much used by fishermen for tanning their nets. The heartwood, which is dark brown, hard, and fairly durable, is used for various industrial purposes.

Description.—The seeds are very hard and not unlike those of *Cassia Fistula*, but smaller. They have a nauseous taste with some astringency. The flowers form largish globular heads of a yellowish-white colour, those of *A. Lebbek* being larger than those of *A. odoratissima*. The bark of *A. Lebbek* has a rugged brown suber, much pitted and fissured, which can be separated in large flakes, leaving exposed a pitted irregular light red surface. The substance of the bark is light red, hard and gritty; it has an acidulous and astringent taste. The inner surface is white and woody.

Chemical composition.—The bark yields to boiling water 12 per cent. of extract, containing 7·4 per cent. of a tannin, which is coloured green by ferric salts. It yields to alcohol 14 per cent. of extract containing a resin besides the tannin. Ether removes from the powdered bark a body allied to catechin. After exhaustion with boiling water and alcohol a large quantity of red colouring matter is dissolved by caustic alkali. The ash amounts to 9 per cent.

Albizzia amara, *Boivin, Roxb. Cor. Pl., t.* 122, a tree of the Western Peninsula and Ceylon, has a medicinal reputation similar to that of *A. Lebbek* and *A. odoratissima.* For a description of the gum of these trees, see *Substitutes for Gum Arabic.* The insoluble gum of **A. stipulata** is used by the Nepalese for sizing their Daphne paper.

ROSACEÆ.

AMYGDALUS COMMUNIS, *Linn.*

Fig.—*Bentl. and Trim., t.* 99. Almond tree (*Eng.*); Amandier commun (*Fr.*).

Hab.—Europe, Central Asia. The almonds.

Vernacular—Badám (*Hind., Guz.*), Vádam-kottai (*Tam.*), Bádam-vittulu (*Tel.*), Bádámi (*Can.*), Biláti-badám (*Beng.*), Bádám (*Mar.*); Bitter almonds, Kurwe-bádam (*Hind.*), Kashappu-vadamkottai (*Tam.*), Chedu-bádam-vittulu (*Tel.*), Tikta-bádámi (*Can.*), Karú-bàdám (*Mar.*), Karavú-badám (*Guz.*).

History, Uses, &c.—Almonds are mentioned in the Book of Genesis as having been carried into Egypt from Palestine as a present by the sons of Israel; they are frequently noticed by Theophrastus*; Dioscorides† describes the use of the root, seeds and gum of the bitter almond tree as medicinal agents. Pliny also was acquainted with almonds and the almond tree (amygdala).‡ He, as well as Celsus and Columella,

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* H. P. I. 18, 19, 21, 23; II. 3; VII. 12; IX. 1.

† Dios. i., 144. ‡ Plin. 15, 24; 23, 75.

speak of '*nux amara*,' 'the bitter almond'; almonds were also called *Avellanæ Græcæ* and *Nuces Græcæ* by Latin writers. Much interesting information having regard to the ancient history of almonds in Europe may be found in the *Pharmacographia*. In India the almond, though probably indigenous to Cashmere and the Himalayas, does not appear to have attracted the same attention as in Europe. In some Sanskrit works it is mentioned under the name of Bádáma, the same name which it bears in Persia, where the tree is very common and the fruit much used. When the Mahometans settled in India, almonds were probably for the first time introduced into the southern and central parts of the country as an article of commerce from Persia and Afghanistan. Arabic and Persian writers on Materia Medica discuss their properties at considerable length. The uses to which they put sweet almonds are essentially the same as with us. Almonds are chiefly cultivated in the districts of Yezd and Kirman in Persia and the more temperate parts of Afghanistan.

The author of the *Makhzan-el-adwiya* mentions two kinds of sweet almond, the thick-shelled and the thin or Kaghazi (*Amandes des dames* or *Amandes Sultanes, Fr.*). He describes the method of extracting the perfumes of flowers by means of almonds placed in contact with them, and says that the oil being afterwards expressed retains the perfume. He also notices the use of the burnt shells as tooth powder, and of the unripe fruit (*Chugala*) as an astringent application to the gums and mouth. Bitter almonds (*Louz-el-murr*) are described by Mahometan writers as attenuant and detergent; they are recommended both internally and externally for a variety of purposes. As a plaster made with vinegar they are used to relieve neuralgic pains; as a collyrium, to strengthen the sight; in emulsion with starch and peppermint, to allay cough. They are also considered to be lithontriptic and diuretic, and of use for removing obstructions of the liver and spleen; applied to the head they kill lice; as a suppository they relieve pain in difficult menstruation; as a poultice they are a valuable application to irritable sores and skin eruptions. The

root of the tree is described as discutient and alterative; it is used both internally and externally. The gum with that of the plum tree, known in Bombay as "*Badami gond,*" is one kind of Hog gum or Gum Bassora of European commerce, and is used in the East as a cheap substitute for more soluble gums. The oil of almonds is not an article of commerce in India.

Description, &c.—For a description of the fruit we may refer the reader to standard botanical works. Persian almonds are inferior in appearance to Jordan almonds; they may be classed with those known in London as Valencia and Sicily. Almonds should have a perfectly bland, sweet, nutty flavour when the outer brown skin has been removed. They contain no starch; the skin is astringent from the presence of tannic matter. Bitter almonds, except in taste, have the same physical characters as sweet almonds.

Chemical composition.—The following represents the mean proximate composition of almonds from analyses by Fleury, König and Kranch:—

Water	5·39	per cent.
Nitrogenous matter	24·18	„
Fat	53·68	„
Non-nitrogenous extractive ...	7·23	„
Cellulose	6·56	„
Ash	2·96	„

When dried they contain 56·86 per cent. of fat and 4·08 per cent. of nitrogen. Fleury found that the total amount of sugar, dextrin and mucilage was 6·29 per cent., the last mentioned constituent being present in very small amount. Almond oil is more thickly fluid than poppy seed oil, but more thinly fluid than olive oil, it is clear and odourless, pale yellow in colour, and possesses a very agreeable mild taste. At —10°C. the oil becomes thick, at— 16° C. it assumes a white turbidity, and at — 20° C. it solidifies to a white butter. At 20° C. it has a specific gravity of 0·917 and at 15° C. 0·919. Exposed to air the oil readily turns rancid, and acquires a disagreeable

taste and odour, and a higher specific gravity. According to Allen almond oil consists chiefly of triolein, more or less tripalmitin, and probably its homologues being also present; it is also stated to contain traces of cholesterin, and to be thus distinguished from poppy, sesame, rape and olive oil. By pressure sweet almonds yield on an average 45 per cent. of oil, and bitter almonds 38 per cent. (*Brannt.*)

Bitter almonds contain a glucoside called *Amygdalin*, $C^{20}H^{27}NO^{11}$, and a neutral principle called emulsin or synaptose—also a constituent of sweet almonds—which possesses the power of acting as a ferment on the amygdalin in the presence of water, converting it into benzoic aldehyde (oil of bitter almonds), hydrocyanic acid and glucose. By boiling, however, the hydrolytic power of emulsin is destroyed. The presence of amygdalin is not confined solely to bitter almonds, it is present also to a small extent in sweet almonds, and in many plants, chiefly belonging to the Amygdalaceæ, Drupaceæ and Pomaceæ: bitter almonds contain 2·8 to 4 per cent.; peach kernels 2·35 per cent.; cherry kernels ·82 per cent.; plum kernels ·96 per cent.; and apple pips ·6 per cent. Amygdalin also occurs in other parts of these plants; also in the leaves of the *Cerasus Laurocerasus*; in the bark, flowers, and leaves of the *Prunus Padus*; in the seeds and bark of *Sorbus Aucuparia*, in the hawthorn, &c. All these portions of the plants yield oil of bitter almonds, containing hydrocyanic acid on distillation with water. The shrubby members of the *Spiræa* family yield a distillate which contains hydrocyanic acid, but it has not been decided whether the hydrocyanic acid thus yielded is derived from amygdalin. Similar remark also apply to the hydrocyanic acid present in the sap of the bitter cassava, from which arrowroot is prepared: in the *Chardenia eranthemoides*, in the fruit of the *Ximenia americana*, in *Ipomœa dissecta* and *Agaricus oreades*, while the seeds of the *Vicia sativa*, which do not contain amygdalin yield both benzoic aldehyde and hydrocyanic acid, benzoic aldehyde being also found in the germinating seeds of cress. According to Frerichs and Wöhler amygdalin is not poisonous: but Moriggia and Ossi assert that the principle exerts a

poisonous action, even in the absence of emulsin, especially on graminivora. (*Ber. Deutsch. Chem. Ges. IX.* 198.) being also found in the germinating seeds of cress. Benzoic aldehyde or oil of bitter almonds is prepared on the large scale by distilling with water the residue of bitter almond cake left after expression of the fixed oil, the yield being ·9 per cent. on the pressed residue, while on the large scale the amount is ·74 to 1·67 per cent., or ·42 to ·95 parts per 100 of unpressed bitter almonds, the variations in yield being attributed chiefly to the varying amount of amygdalin present. The crude oil of bitter almonds contains, according to Brannt, 13 per cent. of anhydrous hydrocyanic acid. When pure it is colourless, and has a specific gravity at 15° C. of 1·0430. For further particulars regarding the chemistry of the principles present in bitter almonds, we would refer the reader to Watt's *Dictionary of Chemistry*, 2nd Edition, and to Roscoe and Schorlemmer's *Treatise on Organic Chemistry*, from which sources the greater part of our information has been abstracted.

Commerce.—Almonds are imported into Bombay from the Persian Gulf in large quantities (16,000 to 20,000 cwts. annually). Value, Abushahrí, Rs. 4 per Surat maund of 37½ lbs.; Kaghazí (thin shelled), Rs. 12; Bunderí, of handsome appearance but having small kernels, Rs. 3⅞; Asmaní, Rs. 3⅝. Almonds are also largely imported into India from Cabul.

In addition to bitter almonds, the natives of the East use the following drugs which yield hydrocyanic acid:—

Prunus Mahalib, *Linn.*, Gávala or Gahula (*Indian*), Mahalib (*Arab.*), Paiwand-i-miryam (*Pers.*), a native of Central Asia and Europe, and the Quénot or Malague of the French. The kernels.

Prunus Pudum, *Roxb.*, Padma-káshtha (*Ind.*), a native of Central Asia. The bark.

Prunus sp.? Alúbálú (*Ind.*). The stones.

The first drug consists of small almonds of a pale buff colour, the skin is thin and marked with longitudinal veins; amongst them a few entire stones may be found, these have very fragile

shells of a pointed oval shape, about $\frac{4}{10}$ of an inch long and $\frac{2}{10}$ broad. The almonds when chewed have a strong flavour of hydrocyanic acid; they are the محلب (Mahalib) of the Arabian physicians.

The second drug consists of the smaller branches of the tree, usually $\frac{1}{4}$ of an inch or less in diameter, but sometimes much larger, the bark of which evidently contains amygdalin. It is described as cooling and tonic.

The third drug has exactly the appearance of common cherry stones, the kernels of which contain the elements of hydrocyanic acid. It is the κεράσια of the Greeks and the آلو بو علي (Alú-bú-ali) of Mahometan writers on Materia Medica, Alúbálu being an Indian corruption of the name. Mahometan physicians describe these drugs as strengtheners of the nervous system, and antilithics.

PRUNUS INSITITIA, *Huds.* var. bokariensis.

The Bokhara plum (*Eng.*).

Hab.—Central Asia. The dried fruit.

Vernacular.—Alu-bokhára (*Ind.*), Alpogáda-pazham (*Tam.*), Alpogáda-pandlu (*Tel.*).

Description, Uses, &c.—The Bokhara plum in a dry state is commonly met with in Indian bazars, being used much as prunes are with us in Europe. It may be considered the officinal prune of India, and may be made use of in the preparation of confection of Senna, and for any other purpose to which prunes are applicable. The author of the *Makhzan-el-adwiya,** after noticing several kinds of plum which are common in Persia and the neighbouring countries, goes on to say that for medicinal purposes the amber-coloured Bokhara plum is to be preferred. He describes it as sub-acid, cold and moist, digestive and aperient, especially when taken on an empty stomach, useful in bilious states of the system and heat of body. The root, he says, is astringent, and the gum a substitute for Gum Arabic, and often called Persian gum

* Conf. Makhzan, article اجاص.

He also notices the wild plum (probably *P. spinosa*), and says that a kind of dry cake is prepared from the pulp, and used medicinally on account of its acid and astringent qualities; and an astringent kind of plum from Damascus which the Turks call Fakúmílás, evidently a corruption of the Greek κοκκυμηλέα, see Dioscorides (i., 142) and Theophrastus (H. P. IV. 2, 10), who describe prunes as coming from Damascus. Pliny mentions twelve kinds of plum (15, 12), and also notices the medicinal use of the leaves as an astringent and the fruit as an aperient. (23, 66.)

The Bokhara plum as met with in commerce is about the size and shape of the dry prune of Europe, but of a lighter colour, the skin having been removed; it is very acid, but on the addition of a little sugar the taste is agreeable and refreshing. Prunes contain free malic acid, sugar, and albuminoid and pectic substances; what the supposed laxative principle is has not been determined.

Chemical composition.—The dried Bokhara plum as sold in the bazars, deprived of seeds, has the following percentage composition:—

Moisture in vacuo over sulphuric acid	6·24	per cent.
Ash	3·39	„
Extractive matter soluble in boiling water	74·10	„
Ash in extractive matter	4·58	„
Principles precipitated by absolute alcohol from aqueous extract	12·68	„
Ash in absolute alcohol precipitate.	·226	„
Saccharine matter possessing a reducing action on alkaline copper solution, without previous ebullition with acids	44·63	„
Total free and combined citric acid	3·05	„
Total free and combined malic acid	1·98	„

The total alkalinity of the ash expressed as KHO was equal to 61·76 per cent. calculated on the ash: the alkalinity of the aqueous extractive ash calculated in a similar manner being equal to 44·44 per cent. of KHO. The total free acidity of the fruit expressed as Na HO was equivalent to 3·80 per cent.

Commerce.—The imports of Alú Bokhárá into India are considerable, as it is much used as an article of diet. Value, Rs. 8 to 12 per Surat maund of 37½ lbs. The price varies with the quantity in the market; there is but little difference in quality.

HAGENIA ABYSSINICA, *Lam.*

Fig.—*Bentl. and Trim. t.* 102.

Hab.—Abyssinia. The flowers.

Vernacular.—Kassu (*Guz.*)

History, Uses, &c.—This drug appears not to have been known in India until within the last quarter of a century, when a demand for it in Europe having sprung up, it began to be imported into Bombay from Abyssinia *viâ* Aden. The use of the flowers as an anthelmintic by the Abyssinians was first made known by Bruce in 1773. In 1811 the plant was described by Lamarck, who named it Hagenia, in honour of Dr. Hagen of Königsberg. The name of Brayera, which it also bears, was given it in honour of Brayer, a French physician of Constantinople, who wrote a pamphlet upon its use as an anthelmintic. In 1850 it was introduced into Europe, and in 1864 it became official in the British *Pharmacopœia.* At the present time the imports into Bombay are declining, and there appears to be very little demand for the drug in Europe. M. W. Schimper, Governor of Adoa, in an excellent article upon Cousso, mentions several other vermifuges used by the Abyssinians—*viz.*, Habbi-tchogo, bulbs of *Oxalis anthelmintica;* Habbi-tsalim, *Jasminium floribundum;* Bolbidá, *Celosia adoensis;* Musenna or Muséna, bark of *Albizzia anthelmintica,* from which M. Thiel has extracted Muséninc; Saoria, seed of

Maesa picta or *lanceolata;* Angogo or Ogkert, *Silene macrosolen;* Tatzé or Zareh, fruit of *Myrsine africana.*

Kousso has been employed from time immemorial in Abyssinia for the expulsion of tape-worms, which there prevail extensively. But it is stated by Johnson that its operation is so severe that it often produces miscarriages, and even death, in pregnant women. In Europe it is said sometimes to have occasioned severe colic, but generally its operation is not distressing, and consists only of slight nausea, followed by feculent and then by liquid stools. According to Arena, these differences depend upon an alteration which the resin undergoes by time. Of all the remedies for tape-worm (*Tænia solium, T. bothriocephalus*) none is more efficient or certain, provided that the flowers are fresh, but they deteriorate rapidly. The parasite is generally discharged dead.

The Abyssinian mode of using it is thus described: An infusion is made with water or beer, or the flowers are mixed with honey to the amount of from 4 to 6 drachms, and the whole is taken in the morning, fasting, and no food is eaten during the day. Generally, the worm is discharged in the course of 24 hours without purging, pain, or colic. This description by Aubert and by Engleman, contradicts the one given above. In Europe and in this country an infusion is prepared with 2 drachms of the powdered drug in 4 fluid ounces of boiling water, which, when cold, is drunk without having been strained. Kraus recommends 25 Gm. (ʒvi) in lemonade on an empty stomach, and followed an hour later by castor oil. As its taste and smell are disagreeable, resembling somewhat those of senna tea, it has been proposed to administer the powder in granules made with sugar and swallowed with some aromatic infusion. The following mode of preparing the dose has been recommended: Treat by displacement ½ ounce of kousso in powder with 6 drachms of boiling castor oil and 1½ ounces of boiling water. Express the liquid, and make an emulsion with it and the yolk of egg; add 40 drops of sulphuric ether, sweeten, and flavour with oil of anise. This emulsion should be taken, fasting, at one dose. In all cases

the patient should fast the day before using the medicine. (*Stillé and Maisch.*)

Description.—The panicles are about 12 inches long, much branched; axis and branches zigzag, hairy, and glandular, each branch supported by a ciliate sheathing bract; flowers very numerous, ¼ to ⅓ inch broad, each with two large roundish membranous-veined bracts at the base, which are green in the staminate flowers, but become purplish-red in the pistillate flowers; calyx shortly stalked, top-shaped, hairy, and with ten membranous and veined segments arranged in two alternating whorls. The sepals of the outer whorl of the male flowers are greenish-yellow, small, and nearly linear; but in the female flowers they are finally about ⅜ inch long, and much larger than the inner row of sepals, and when fully developed are obovate and of a red color. The five linear petals are inconspicuous and much shorter than the inner sepals, with which they alternate. Stamens between fifteen and thirty, very small and shrivelled in the female flowers, equalling the petals in the male flowers, inserted in the contracted throat of the calyx. Carpels two, or occasionally three, distinct, enclosed in the calyx tube; styles projecting from the tube; fruit a small membranous achene, pointed by the persistent short base of the style, and containing a straight fleshy embryo with two plano-convex cotyledons.

The female inflorescence being most frequently collected, the commercial article should have a pale brownish-red hue, and is often distinguished as *red kousso.* It is collected before the fruit has ripened, and either the entire inflorescence is dried loosely, or before quite dry a number of panicles are formed into cylindrical rolls, measuring about 10 to 20 inches in length, weighing about 4 to 8 ounces and tied by split culms of *Cyperus articulatus*; the loose panicles are usually much broken. The male inflorescence has in the dry state a light greenish-brown colour, and is sometimes known as *kousso-esels.* The odour of both varieties is not strong, but pleasant and tea-like; the taste is gradually developed, mucilaginous, bitterish, acrid, and disagreeable. (*Stillé and Maisch.*)

Chemical composition.—According to Wittstein (1840), kousso contains as principal constituents 6·25 per cent. of a bitter acrid resin and 24·4 per cent. of tannin, consisting of two kinds; he also obtained 15·71 per cent. of ash and some tasteless resin, besides the common constituents, chlorophyll, wax, sugar, and gum. The acrid resin appears to be the medicinally active principle, and has been variously called *brayerin, kwosein, koussin,* and *kosin.* As prepared by Dr. C. Bedall (1872) by Pavesi's process, it was found to be an efficient tænifuge. Kousso is repeatedly treated with alcohol to which slaked lime has been added; the residue is boiled with water, the different liquids mixed, filtered, and distilled, and the remaining liquid treated with acetic acid, which separates about 3 per cent. of koussin as a white flocculent precipitate, becoming denser and resin-like and on drying yellowish or at a higher temperature brown; in larger quantities it has a peculiar odour of Russian leather, a persistent bitter and acrid taste, and is of a distinct crystalline appearance when viewed under the microscope. Dr. E. Merck has subsequently further purified it, probably by crystallizing it from boiling alcohol. Flückiger and E. Bury (1874) describe it as forming yellow rhombic crystals, which are readily soluble in benzol, bisulphide of carbon, chloroform, and ether, less freely in glacial acetic acid, sparingly in cold alcohol, and are insoluble in water; alkalies dissolve it readily and acids precipitate it again; it fuses at 142° C. and congeals to a transparent yellow mass, which when touched with a trace of alcohol is converted into stellate tufts of crystals; its composition is $C^{31}H^{38}O^{10}$, and it is probably an ether of isobutyric acid. M. Liotard regards the active principle as an acid; it combines with alkalies and oxide of lead. Prof. Buchheim found this *pure kosin* to be very inferior in its anthelmintic action.

By distillation with water, kousso yields traces of valerianic and acetic acids and a little solid volatile oil having the odour of the drug and without any tænifuge properties. (*Stillé and Maisch.*)

ROSA DAMASCENA, *Miller*.

Fig.—*Miller Laur. Ros. t.* 38. Damask Rose (*Eng.*), Rosier de Damas (*Fr.*).

Hab.—Syria. Cultivated in India. The petals, stamens, and essential oil.

Vernacular.—Guláb-ke-phúl (*Hind.*), Guláppu, Irojáppu (*Tam.*), Gulap-phúl (*Beng.*), Roja-puvou, Gula-puvou (*Tel.*), Gulabi-huvou (*Can.*), Gulápha-cha-phúla (*Mar.*), Gulab-nu-phùl (*Guz.*).

History, Uses, &c.—Roses are mentioned by the oldest Greek writers, and among the ancients were sacred to Dionysus and Aphrodite. Under the Romans one of the principal Bacchic festivals was called '*Rosalia,*' and roses were used on all festive occasions. The famous rose gardens of Midas were situated in Macedonia, the modern Bulgaria, still famous for the production of Otto of Roses. The Rose has given rise to innumerable solar myths both in the East and in the West, one of the prettiest being the well-known story of Gul-i-Bakawli. Dioscorides mentions the astringent properties of rose petals, the use of their ash as a collyrium, and the medicinal use of the stamens. The Sanskrit names for different kinds of roses appear to be modern, Satapattri (centifolia) being the name for *R. damascena.* The variety known as the *Bengal rose,* (**R. involucrata**) with a white flower not unlike the English *dog rose* in appearance, is of interest, as its perfume is quite distinct from that of ordinary roses, and is like that of the jargonelle pear, due probably to the presence of amyl acetate.

Pliny (21, 10,) describes twelve varieties of the Rose, and (21, 72,) thirty-two remedies derived from them. Under the name of *Ward* the following kinds of rose are noticed in Arabic and Persian works:—White wild rose, Red wild rose, Red garden rose, Yellow wild rose, Yellow garden rose, Dalik or Dog rose, White cluster rose, and a wild rose called *Ward-el-hamak,* the petals of which are described as yellow outside and red within.

Of these the red garden Rose appears to be the *R. damascena* which is cultivated both in Persia and India for officinal purposes, and is the kind from which Rosewater and Oil of Roses are usually obtained. In India Rose buds are preferred for medicinal use, as they are more astringent than the expanded flowers; they are considered to be cold and dry, cephalic, cardiacal, tonic and aperient,* removing bile and cold humours; externally applied the petals are used as an astringent. The stamens are thought to be hot, dry and astringent, and the fruit is credited with similar properties. Notices of the fruit of *R. canina* will be found in Arabic works under the name of Dalík. The Rose stamens (Tukm-i-gul or Rose-seed) of the shops are supposed to be derived from this plant, but are really those of *R. damascena;* the ancients also called the stamens seed. Pliny says: "In the flower there is the seed as distinguished from the filaments," and again, "As to the seed of the rose the best is that which is of a saffron colour." The following preparations made with the petals of *R. damascena* are used as medicaments :—

Duhn-i-ward-i-khám.—A fatty oil made by exposing Rose leaves and sweet oil to the sun and then filtering.†

Duhn-i-ward-i-matbúkh.—A similar preparation made by heating the petals with sweet oil over the fire. Both of these oils are considered to be deobstruent, astringent and aperient; they are also recommended in poisoning by caustic alkalies.

Gulkand.—A conserve made from equal parts of Rose petals and white sugar beaten together; it is considered tonic and fattening, and is much used by women and old people. Ibn Sina says that he cured a consumptive young woman with it. To this preparation *Cannabis indica* is sometimes added in India.

Gulangabín.—A similar preparation made with honey and considered to have much the same properties.

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* For an aperient, the dried buds are boiled with rice, and ghi and sugar are added.

† The ῥόδινον ἔλαιον of the Greeks. Conf. Dios. i., 44.

Guláb.—Rosewater is largely used in native practice in much the same way as orange flower water is by the French.

Guláb-ka-attar.—Otto of Roses, having properties similar to those of Rosewater, is made in Persia and India, but not in sufficient quantity to supply the Indian market; a good deal has therefore to be imported from Turkey. Rosewater is manufactured in Bengal and the Punjab, and a large quantity is imported from Persia. An account of the preparation of Rosewater and otto at Gházípur in Bengal will be found in the *Bengal Dispensatory*. It appears that the common native still is used (this is simply a rough form of alembic without a condensing worm), and that one hundred thousand roses produce about 100 bottles of Rosewater. Otto is only made in cold weather. To obtain it the Rosewater is exposed to cold in shallow vessels, a thin film forms upon the surface, and is removed with a feather. One hundred thousand roses are estimated to produce about 180 grains of otto. Otto is said to have been first discovered in India by Núr-i-jehán Begum, A.D. 1612. On the occasion of her marriage with the Emperor Jehángír, the Queen is said to have observed a scum upon the surface of the Rosewater with which the canals in the gardens of the palace had been filled, and ordering it to be collected found it to have a delicious fragrance. For an interesting history of otto and its introduction into Europe the *Pharmacographia* may be consulted. Colonel Polier (*As. Res. i.*, 332), who describes the process of preparing otto in India, as conducted by himself, says:—"The colour of the *attar* in different years varies greatly when obtained from roses grown on the same ground. Emerald-green, bright yellow, or reddish attar is often seen. The calyx may be left, as it does not affect the quality of the oil, or impart any colour to it. The yield in the most favourable seasons is 3 drachms per 100 lbs. of rose leaves.

Description.—*R. damascena* is a shrubby plant, with numerous unequal strong prickles, dilated at the base; leaflets 5 to 7, ovate, stiffish; flower-bud oblong, sepals deflexed after he flowers have opened; tube elongated, often dilated at the

top; fruit ovate, pulpy; calyx and peduncles glandulosely hispid, viscous; colour of flower light red.

Chemical composition.—Pure oil of roses carefully distilled is at first colourless, but quickly becomes yellowish. Its specific gravity at 22°·9 C. is ·870 and its boiling point 228°·8 C., it solidifies at 11°·1 to 10°·1 C., and is soluble in absolute alcohol and in acetic acid. (*Brannt.*) Rose oil is a mixture of a liquid constituent containing oxygen, and a hydrocarbon or stearopten, $C^n H^{2n}$, which is not altered by boiling with alcoholic potash, and which is entirely destitute of odour. From the Turkish oil it may be obtained to the extent of 12 to 14 per cent., in the German oil it is present to the extent of 32 to 34 per cent. The liquid portion of Rose oil has not yet been obtained entirely free from the stearopten. To isolate the stearopten, Messrs. Schimmel heated fifty grams of oil with 500 grams of 75 per cent. spirit to a temperature of 70° to 80° C., upon cooling, the stearopten separated almost entirely. It was then removed from the liquid and treated similarly with 200 grams more of 75 per cent. spirit, and this operation was repeated until the stearopten was obtained perfectly odourless.

Rose oil, from which the stearopten has been removed in the above described manner, is perfectly liquid at 0° C.; but when placed in a cooling mixture it solidifies to a gelatinous mass, showing that it is not quite free from stearopten. This liquid oil is described as having an extraordinarily fine and powerful odour, and as presenting the advantage that when used dissolved in spirit it does not give rise to any crystalline separation.

If cautiously melted by the warmth of the sun, the stearopten forms on cooling microscopic crystals of very peculiar shape. Most of them have the form of truncated hexahedral pyramids, not however belonging to the rhombohedric system, as the angles are evidently not equal; many of them are oddly curved, thus §. Examined under the polarizing microscope, these crystals from their refractive power make a brilliant

object. (*Messrs. Schimmel & Co.'s April Bericht,* 1889; *Pharmacographia.*)

Adulterations.—According to Brannt, the most usual and reliable tests of the quality of Rose oil are : its odour, its congealing point, and its crystallization. Much of the Persian Rosewater is diluted with water in Bombay before it is sold. Pure otto is hardly to be obtained; it undergoes adulteration before it is shipped to Bombay, and on arrival is still further falsified by a large admixture of Sandalwood oil, reducing its value from Rs. 16 to Rs. 2 per tolá. In the preparation of adulterated otto in India sandalwood chips are added to the roses in the still.

We have been unable to ascertain that otto is ever adulterated with Rusa grass oil in India, nor do the dealers in the latter article appear to know anything about its use in Turkey for this purpose.

Commerce.—The Indian market is supplied with dry Roses from all parts of the table land; both buds and expanded flowers arrive together, and are valued at about Rs. 4½ per Surat maund of 37½ lbs. The buds are separated and sold for Rs. 7 per maund. The expanded flowers are worth only Rs. 3 per maund, and are purchased for the preparation of Gulkand. Rosewater, to the extent of 20,000 to 30,000 gallons annually, is imported into Bombay from the Persian Gulf; two qualities are met with, Yak-atishi (once distilled) and Du-atishi (twice distilled). Value, Rs. 4 to Rs. 4½ per carboy of 20 lbs.

Otto of Roses is imported from Persia and Turkey, and a small quantity is made in India. In Bulgaria, which is the chief seat of manufacture, it is packed in squat-shaped metal flasks holding from 1 to 10 lbs., sewn up in white woollen cloths. Their contents are frequently transferred at Constantinople into small gilded bottles for export. The value of an average harvest is from $3,500,000 to $4,500,000. (*Brannt.*)

PYRUS CYDONIA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 106. Quince tree (*Eng.*), Coignassier commun (*Fr.*).

Hab.—Central Asia, cultivated in all temperate climates. The seeds.

Vernacular.—Bihi-danah (*Hind.*, *Guz.*, *Mar.*), Shimai-madalaivirai (*Tam.*), Shima-dálima-vittulu (*Tel.*), Shime-dalimba-bija (*Can.*).

History, Uses, &c.—The quince was called by the Greeks *Chrysomela* and by the Romans *Malum aureum;* it was sacred to Venus. Plutarch states that it was a popular custom for the bride to eat a quince before mounting the nuptial couch. Virgil in his third Eclogue has an allusion to this custom :—

> Malo me Galathea petit, lasciva puella,
> Et fugit ad salices.

According to Mattioli (*De Plantis*) it is considered in Spain to be an antidote to Hellebore. (*Gubernatis Myth. des Plantes.*) The author of the *Makhzan* describes three kinds of quince (*Safarjal*)—the sweet, the sour and subacid, called in Arabic *Muzz.* The sweet and subacid quinces are commonly eaten as a fruit by the Arabs and Persians, and are considered cephalic, cardiacal and tonic; they are also eaten baked. The leaves, buds and bark of the tree are domestic remedies among the Arabs on account of their astringent properties. In Persian *Karabádíns* (Pharmacopœias), a number of receipts for making conserves, lozenges, &c., of the fruit, as well as a conserve of the flowers, will be found.* In India we only meet with the seeds as an article of commerce. They are considered cold, moist, and slightly astringent, and are one of the most popular remedies in native practice, the mucilage being prescribed in coughs and bowel complaints as a demulcent; externally it is applied to scalds, burns and blisters.

* Conf. Dioscorides v., 20, *et seq*, for Quince Wine, Quince honey, &c. κυδωνίτης οἶνος καὶ κυδωνόμελι; κ.τ.λ. Pliny, 23, 54.

Description.—The quince resembles a pear in shape and size; when ripe it is of a golden yellow colour. The kind commonly cultivated in Europe is sour and astringent, but has an agreeable and aromatic smell. In Arabia and Persia sweet edible quinces are grown, and are commonly offered for sale. In structure the quince differs from the pear in having numerous seeds in each cell, which cohere together by the mucilaginous membrane with which each seed is surrounded. The seeds are irregularly ovoid, flattened and three-sided from mutual pressure. At the lower end is the hilum, from which the raphe extends as a straight ridge to the opposite extremity, which is slightly beaked and marked with a scar indicating the chalaza. The testa is of a dark brown colour, and encloses two cotyledons and a straight radicle directed towards the hilum. The kernel has the odour and taste of bitter almonds, but the testa is simply mucilaginous.

Chemical composition.—According to the *Pharmacographia* the mucilage of the epidermis is present in such quantity that the seed easily coagulates forty times its weight of water. By complete exhaustion, the seeds afford about 20 per cent. of dry mucilage, containing considerable quantities of calcium salts and albuminous matter, of which it is not easily deprived. When treated with nitric acid, it yields oxalic acid. After a short treatment with strong sulphuric acid it is coloured blue by iodine. Tollens and Kirchner (1874), assign to it the formula $C^{18}H^{28}O^{14}$, regarding it as a compound of gum, $C^{12}H^{20}O^{10}$, and cellulose, $C^{6}H^{10}O^{5}$, less one molecule of water. Quince mucilage has but little adhesive power, and is not thickened by borax. That portion of it which is really in a state of solution, and which may be separated by filtration, is precipitable by metallic salts or by alcohol. The latter precipitate after it has been dried is no longer dissolved by water either cold or warm. Quince mucilage is, on the whole, to be regarded as a soluble modification of cellulose. Gans and Tollens show that quince mucilage yields furfuraldehyde on distillation with dilute sulphuric acid, indicating

the presence of arabinose or xylose, but no crystalline carbohydrate was isolated. The syrup contains no dextrose or galactose, as neither saccharic nor mucic acid were formed on oxidation. (*Journ. Chem. Soc.,* May 1889, p. 541.) Lancaster (*Am. J. Pharm.,* xxxi., 198,) obtained 1·6 grm. of crystallized malate of lead from the acid contained in 453 grms. of the fruit. Wöhler (*Ann. Pharm.,* 41, 239,) by distilling ripe quinces with water, obtained a trace of an oily liquid possessing the odour of the fruit, and which he considered to probably contain œnanthic ether. Artificial essence of quinces consists of ethyl pelargonate. The seeds contain about 15 per cent. of a very mild oil (*Brannt*), and according to Warnecke, yield 3·55 per cent. of ash, possessing the following percentage composition: Potash 27·09, soda 3·01, magnesia 13·01, lime 7·69, phosphoric acid 42·02, sulphuric acid 2·67, silica ·75, peroxide of iron 1·19, chloride of sodium 2·57. (*Kensington.*)

Commerce.—Quince seeds are imported into India from Afghanistan, Persia, and Cashmere. Value, Rs. 10 to Rs. 25 per Surat maund of 37½ lbs., according to quality.

The imports from Cashmere are valued at Rs. 7,000 yearly.

Anchanchak or Anjukak.—Under these names the seeds of the wild pear of Persia (*Pyrus communis,* Linn.,) are sold in the Indian bazars; they are much larger than those of the cultivated tree. Aitchison (*Botany of the Afghan Delimitation Commission*) remarks: "In the Badghis I came upon a small forest of Pear-trees, which I thought might have been the remains of an old orchard, but I was informed that this was not the case. The tree is well known as a wild one. It is called *amrucha* from the small fruit it bears, this being a diminutive for *amrud.* The fruit is dried, ground into a flour, and mixed with ordinary wheat flour." The seeds are eaten and are considered to be very strengthening.

AGRIMONIA EUPATORIUM, *Linn.*

Fig.—*Wallroth Beiträg. Bot.* 1. 54, *t.* 1, *f.* 9; *Camb. in Jacq. Voy. Bot.* 55, *t.* 68. Agrimony (*Eng.*), Aigremoine (*Fr.*).

Hab.—Temperate Himalayas, Persia, Europe. The herb and fruit.

Vernacular.—Shajrat-el-barághis, Shaukat-el-muntineh (*Arab.*)

History, Uses, &c.—This herb is the εὐπατώριον of the Greeks Dioscorides (iv., 39) describes it as having inverted fruit, so rough and bristly that they adhere to the clothes when ripe. The fruit and herb was used both externally and internally as an aromatic astringent. Pliny (25, 29) says:—"The Eupatoria also is a plant under royal patronage (Eupator Mithridates, king of Pontus), the stem is ligneous, hairy, and swarthy, a cubit or more in length. The leaves are arranged at regular intervals and resemble those of cinquefoil (Potentilla) or hemp; they have five indentations at the edge, and are swarthy like the stem and downy. The root is not used. The seed taken in wine is a sovereign remedy for dysentery." *A. Eupatorium* appears to have been known to the Western Arabs under the names of Shajrat-el-barágith and Shaukat-el-muntineh, and latterly as Gháfith or Kháfil. Ibn Sina and the Eastern Arabs and Persians adopted a Persian plant called غافت (Gháfat) as representing the Eupatorion of the Greeks, and describe a plant having the foliage of Agrimony but with a long dark-blue flower. This plant is still sold in the East under the name of Gháfith or Gháfis, and is *Gentiana Olivieri*, Griseb., which Aitchison observed growing in such profusion on the sandy downs of the Badghis as to give a blue colouring to them. It is called *Gul kalli* by the Persian peasants from its being used to cure کلی (kallí) or ringworm of the scalp in children. The Hindus do not appear to be acquainted with the medicinal properties of Agrimony, but it is still used in Europe as a popular astringent and stimulant in gargles for

sore-throat and as a wash to sores. Agrimony tea is used as a domestic remedy for dyspeptic conditions with derangement of the bowels, and also hot to induce perspiration in febrile affections. According to Nicholson (*Med. Times and Gaz.*, 1879, *p.* 367), Agrimony is an efficient tæniacide when given pounded to a pulp, and followed several hours afterwards by a dose of jalap, and also an active diuretic and antiscorbutic. The plant contains 4·75 per cent. of tannin, a fragrant yellow volatile oil, a bitter principle, and a yellow colouring matter, which has been used as a dye.

Bintafalun.—All Indian Mahometan works on Materia Medica contain lengthy descriptions of the virtues of بنطافلن, the πεντάφυλλον or cinquefoil of the Greeks, which is generally identified with *Potentilla Tomentilla*, Sibth., a plant the roots of which were formerly much used in medicine on account of their astringent properties, and which the old physicians considered to have a peculiar action upon the acidities of the stomach and bowels, and to cleanse them from the slimy mucus and sordes with which they were supposed to be loaded. The drug is not obtainable in the bazars, but Dr. Stewart has observed that the roots of *P. nepalensis*, Hook., are used as a substitute for it in the Punjab, and Murray records the use of *P. supina*, Linn., in Sind. *P. nepalensis*, like *P. Tomentilla*, contains tannin and a red colouring matter.

COTONEASTER NUMMULARIA, *Fisch et Mey.*

Fig.—*Trans. Lin. Soc., 2nd Ser. Botany, Vol. iii., Pt. I., Pl. IX.*

Hab.—Persia. The manna.

Vernacular.—Siah-chob, Kashiru (*Pers.*). The manna, Shirkhisht, Shirkhushk (*Pers.*).

History, Uses, &c.—Mir Muhammad Husain remarks in the *Makhzan-el-adwiya* that Shirkhisht or Shirkhushk is not, as is generally stated, a honey dew which falls upon certain trees in Khorasan; but is an exudation from a tree

called *Kashira* by the villagers of that province, a small tree with yellow and white mottled wood, which is much valued for making walking-sticks. The Persian name Shirkhushk signifies "dried milk." Aitchison describes Cotoneaster as a tall shrub or small tree common on all the hills of the Paropamisus range, where there is moisture at 4,000 feet altitude. He says the stems are esteemed for walking-sticks and for handles to agricultural implements. From this shrub a manna called Shirkhisht at a certain season of the year is collected. It is largely exported to Hindustan and Persia. (*Trans. Lin. Soc. 2nd Ser. Botany, Vol. iii., p.* 64.) In India this manna is generally confounded with Gazangabin or Tamarisk manna, both kinds forming one commercial article which is sold under the name of Shirkhisht or Gazangabin. The author of the *Makhzan* describes the manna as readily melting in the mouth with a sweet cool taste; when adulterated with barley flour, as is sometimes the case, it is not wholly soluble. He remarks that the Christians obtain a similar substance from Italy in large quantities, and that in India, in the districts of Behar, Patna, and Bhagulpur, a substance something like manna is prepared by heating the roots of a tree called in Hindi *Katera* over the fire, so as to cause an exudation of juice from the cut ends, which concretes like candy and has the properties of manna. It is called in those parts *Harlálu*. Hakim Mir Muhammad abul Hamid states that he has himself used it as manna.* Manna is much valued in the East, as, in addition to

* A sample of manna from an unknown botanical source, sent to Dr. G. Watt from the Central Provinces, was in whitish masses with a stratified crystalline fracture, sweetish to the taste with an odour of ordinary manna. It was soluble in water with a slight opacity, and the solution was not affected by iodine or lead acetate; it had a slight right-handed rotation on polarized light (4·58°), and the reduction it caused in Fehling's solution showed that it contained 5·84 per cent. of glucose. It dissolved in cold sulphuric acid with a red colour, and boiled with hydrochloric acid it afforded a brown solution. Oxidized with nitric acid white crystals of mucic acid were deposited. It began to fuse at 130° and melted at 140° in brown globules. Dissolved in boiling water and the solution cooled, a crop of hard white crystals separated. These crystals did not reduce Fehling, and their solution had no action on polarized light. They melted not below 160°. The mother liquor was very fermentable, abundantly reduced Fehling, and was dextro-rotatory. The white crystals were not efflorescent, and resembled mannite, except that they were not so soluble in water.

its aperient properties, it is supposed to strengthen the liver, stomach and intestines, and to counteract the hot humours which are liable to be generated in those organs. It is also valued as an expectorant.

Description.—Shirkhisht occurs in small yellowish-white granules about the size of millet seed, mixed with the small ovoid leaves of Cotoneaster. It readily dissolves in the mouth, leaving a sweet cool taste.

Chemical composition.—M. Raby (*Union Pharm., May* 1889, p. 201,) finds it to contain about 8·3 per cent. of glucose, 4·1 per cent. of cane sugar, or an analagous sucrose, and about 50 per cent. of a new sugar, which he proposes to call *chirkhestite.* He separated it by removing the glucose and sucrose by fermentation with beer yeast. Chirkhestite has a composition represented by the formula $C^6H^{14}O^6$, and appears to belong to the mannite group; it is nearly related to sorbite, sorbite melting a little below 100° C. and chirkhestite at 112° C. Sorbite does not affect polarized light, but chirkhestite does, although it appears doubtful whether or no this action is due to impurities. Chirkhestite dissolves in less than half its weight of cold water. (*Pharm. Journ., June* 8*th*, 1889.)

SAXIFRAGACEÆ.

SAXIFRAGA LIGULATA, *Wall.*

Fig.—*Hook. Exot. Fl. i., t.* 49; *Bot. Mag., t.* 3406.

Hab.—Temperate Himalaya. The rhizome.

Vernacular.—Bat-pia, Popal, Ban-patrak, Dakachru (*Hind.*), Páshánbhed, Pákhánbhed (*Indian Bazars*), Atia, Torongsingh, (*Khasia*), Sohaupe-soah (*Nipal*).

History, Uses, &c.—The rhizome is a well-known Indian drug, and is described by Sanskrit writers under the name of Páshána-bheda or "stone-breaker." It is supposed to dissolve gravel or stone in the bladder, and to act as a

diuretic in doses of 15 grains. It is also said to be an antidote to opium, to have tonic properties, and to be useful as an astringent in diarrhœa and pulmonary affections. Sometimes it is applied externally as an astringent. In Sind it is rubbed down with honey into a paste, which is applied to the gums of children when teething; if used freely in this way it may do harm by confining the bowels too much.

Description.—The rhizome occurs in pieces 1 to 2 inches long, and about half to one inch in diameter. The external surface is brown, wrinkled and scaly, and bears numerous scars of rootlets, and circular markings. The substance is dense and hard, with a reddish colour. The rhizome appears to have been cut up before drying. The red colour of the sections is only external, as a fresh cut shows the interior to be much lighter, or almost white. Under the microscope there are seen numerous conglomerate crystals and ovoid starch cells. The taste is slightly astringent, and the odour similar to that of tan, but more aromatic.

Chemical composition.—The ethereal extract of the finely powdered rhizome was of a pale brown colour, somewhat crystalline, and contained the peculiar odorous principle of the drug. The aqueous solution of this extract gave inky mixtures with ferric and ferrous salts, and precipitated gelatine solution. The mixture of tannic and gallic acids was shaken up in solution with pure ether, and the supernatant liquor afforded the gallic acid in a pure condition, known by its reactions with strong sulphuric acid and alkalies, and by mixing clear with gelatine. Alcohol removed from the residue of this extract an odorous body of soft fatty consistence, and the remainder of the extract was a wax, melting about 48° C. The wax was insoluble in cold alcohol, but almost entirely dissolved on boiling, separating into a mass of crystalline plates when cooled, not wholly dissolved after prolonged boiling with alcoholic potash, not soluble in cold or hot sulphuric acid; in the latter it first turned red, then melted and blackened; nitric acid decomposed it into a yellow brittle resin.

The alcoholic extract of the powdered drug contained a large quantity of a tannic acid, with some uncrystallizable sugar. The tannic acid was soluble in hot water and reprecipitated on cooling; its insolubility was prevented by adding ammonia until the cold solution was neutral; neutral plumbic acetate then removed the whole in the form of a reddish-brown sediment. The acid gave a blue-black solution with ferric salts, a precipitate with gelatine, and showed evidence of its glucosidal nature. The acid was very similar to the gallo-tannic acid of oak-galls. The resemblance is very close when comparing their lead salts: gallo-tannic acid leaves 50·00 per cent. of lead oxide, the tannic acid under examination left 50·45 per cent. of oxide as the mean of two fairly concordant estimations.

The filtrate from the lead precipitate, after treatment with hydrogen sulphide, was composed entirely of sugar readily reducing Fehling's solution. No alkaloids or mineral salts were detected.

The aqueous extract contained gum, tannic acid, sugar and a small amount of inorganic salts.

The treatment of the residual powder with a one per cent. soda solution dissolved out some red colouring material and metarabin. On adding acetic acid to the solution, it at once pectinized; this effect was produced also when ferric chloride, iodine in potassium iodide, and sulphuric and hydrochloric acids were added. The pectinization was very remarkable. As it would have required an enormous amount of spirit to cause the precipitate to separate, its estimation would have been attended by a great loss. In the following table, the metarabin, albumen, &c., is the loss on the powdered drug sustained in exhausting it with diluted soda. After prolonged boiling with acid previous to the treatment with soda, the pectinization of the metarabin did not take place when made neutral with acid.

The calcium oxalate was dissolved out by means of five per cent. hydrochloric acid. This salt was in the plant in the form of conglomerate raphides, and its reduction to the form of

carbonate when the plant was burnt constituted the major portion of the ash, which amounted to 12·87 per cent.

The starch was estimated by conversion into glucose by boiling it with a 1 per cent. hydrochloric acid solution for four hours, and titrating the resulting liquor with Fehling's copper tartrate solution.

The table gives the quantity of the different constituents of the rhizome of *Saxifraga ligulata* as far as they were identified in the foregoing analysis :—

Wax and odorous principle	·92
Gallic acid	1·17
Tannic acid	14·28
Glucose	5·60
Mucilage	2·78
Metarabin, albumen, &c.	7·85
Starch	19·00
Calcium oxalate	11·61
Mineral salts	3·80
Sand	·58
Crude fibre	20·80
Moisture and loss	11·61
	100·00

DICHROA FEBRIFUGA, *Lour.*

Fig.—*Wall. Pl. As. Rar.*, *t.* 213; *Bot. Mag.*, *t.* 3046.

Hab.—Himalaya, Khasia mountains, Java, China.

Vernacular.—Basak (*Hind.*), Singnamook (*Bhutan*), Gebokanak (*Lepcha*).

History, Uses, &c.—A shrub of the upper hill forests from 4,000 to 8,000 feet. It was first brought to notice by Loureiro (*Fl. Cochin.* 301), who says:—"It is febrifuge and cures quotidian, tertian, and quartan fevers; if taken in the crude state it usually causes vomiting, but if slowly stewed in wine until the latter has evaporated, it purges the bowels and

removes obstructions of the viscera. The natives use a decoction of the leaves which acts more mildly if combined with liquorice; it is not a very safe remedy for old and weak people."

In Cochin-China it is called Cay-thuong-son and Cham-chau. In Sikkim and Bhutan the root in the form of decoction is in general use as a febrifuge amongst the natives; it first acts as an emetic, and is thus supposed indirectly to carry off the fever. It appears to have no active effects, unless taken in large quantity, when it causes vomiting and depression of the circulation.

Description.—The yellow bark of the branches peels off in flakes. The root bark, which is generally made use of in India, is of a light colour, soft and corky in structure and almost tasteless. It occurs in the form of small chips, and has a faint aromatic odour. If chewed it causes a sensation of nausea. The external surface is fissured longitudinally, the internal is smooth and rather waxy.

Chemical composition.—The ethereal extract of the root-bark contains a crystalline glucoside allied to æsculin, which may be termed *Dichroin.* It gives an opal blue colour with soda solution, and dissolves in sulphuric acid, showing a reddish colour by transmitted light, and a fine mauve-blue by reflected light. Bichromate of potassium with sulphuric acid forms an indigo-blue colour, turning yellow on the addition of a few drops of water. With Nessler's reagent it forms an opalescent solution and precipitate. Most of the alkaloidal reagents precipitate it in acid solution, but not when neutral. It gives a purplish colour with ferric salts, and a pink colour with ferrous sulphate.

A second crystalline principle insoluble in water is also present in this extract; it is soluble in alkaline liquids, and appears to be a kind of wax. Dichroa root, differing from other plants of the order, contains no tannin; a small proportion of starch exists in the bark.

CRASSULACEÆ.

BRYOPHYLLUM CALYCINUM, *Salisb.*

Fig.—*Bot. Mag., t.* 1409; *Hook. Bot. Misc., iii.,* 100.

Hab.—Tropical India. The leaves.

KALANCHOE LACINIATA, *DC.*

Fig.—*Pl. Grasses, t.* 100; *Wight Ic.,* 1158.

Hab.—Deccan Peninsula, Bengal.

Vernacular.—Hemságar, Zakhmhyat (*Hind. Beng.*), Parnabij, Ghaimári, Ghaipat, Aranmaran (*Mar.*), Mala-kulli (*Tam.*), Kalnáru, Haradhachchaka (*Can.*).

History, Uses, &c.—These two plants, as well as **K. spathulata,** *DC.*, a native of the tropical Himalayas, known to the natives of the Punjab as *Talára* and *Haiza-ka-patta,* are called in Sanskrit Asthibhaksha and Parna-vija or "leaf-seed," because their leaves when placed upon moist ground, take root and produce young plants. The leaves slightly toasted are used as a styptic application to wounds, bruises, boils, and the bites of venomous insects. Ainslie, speaking of *K. laciniata,* says: "I can myself speak of their good effects in cleaning ulcers and allaying inflammation." We have seen decidedly beneficial effect follow their application to contused wounds; swelling and discoloration were prevented, and union of the cut parts took place more rapidly than it does under ordinary treatment. The juice of the leaves is administered in doses of ¼ to 1 tola (45 to 180 grains) with double the quantity of melted butter in diarrhœa, dysentery, and cholera; it is also considered beneficial in lithiasis. Corre and Lejanne (*Mat. Med. et Tox. Coloniale*) state that *B. calycinum* is called "*Herbe à mal de tête*" in the Antilles, and is used to cure headache, also that it is a good emollient. They remark that it bears the popular name of "*Langue de femme*" parceque les feuilles séparées de la tige,

donnent naissance à des racines adventives et deviennent le point de départ d'une végétation qui ne s'arrête plus (par allusion sans doute à la difficulté de réfréner............la langue des créoles!

Description.—*B. calycinum* is a tall, fleshy, erect, suffruticose plant, having thick, ovate-crenated leaves, consisting of one large leaflet and two smaller ones; petiole and margin of leaf purple; blossom a terminal panicle of pendulous, tubular, yellowish-red flowers; the leaves have a strongly acid and astringent taste.

K. laciniata has decompound and pinnatifid leaves, the segments oblong-acute, coarsely toothed, upper ones nearly entire; sepals lanceolate-acuminate, spreading; cyme panicled; flowers yellow. *K. spathulata* has the lower leaves commonly 3 to 4 (sometimes 10) inches long besides the petiole; upper leaves (with the petiole) often 3 to 4 inches long by ½ broad, frequently sessile. Flowers clear yellow.

Chemical composition.—The fresh leaves of *B. calycinum* contain in 100 parts:—

Water	89·77
Organic matter	8·72
Mineral matter	1·51

They give up to alcohol chlorophyll, fat, and an organic acid of a yellow colour striking an olive green tint with ferric chloride. Water extracts acid tartrate of potassium, sulphate of calcium and some free tartaric acid. Calcium oxalate occurs in the residual fibrous portion of the leaves.

DROSERACEÆ.

DROSERA PELTATA, *Sm.*

Hab.—Himalayas and Nilgiris, distributed in Malay Archipelago. Peltate Sundew (*Eng.*), Rossolis en bouclier (*Fr.*).

History, Uses, &c.—The Sundews are small herbaceous plants growing in grass land, and are interesting from the fact

that their leaves have glandular hairs which close upon flies and insects that rest upon them. Darwin has proved that animal food is digested by these plants, and it increases their vigour of growth, the weight of the plants themselves, and makes them capable of producing more capsules and seeds. They are bitter, acid and caustic, and applied to the skin cause pain and inflammation. Their blistering properties are known at Madura, and Madden has reported the same effects at Kunawar; Stewart, however, in *Punjab Plants* was not acquainted with these plants west of the Sutlej. The powdered leaves mixed with salt and applied to the arm with a waterproof covering produced a purplish red coloration, and after three hours caused such pain that the poultice had to be removed. On the fifth day inflammation set in and the skin became most tender; on the eighth day it blistered without any inconvenient symptoms, and on the ninth day the coloured skin burst and was removable in a few hours afterwards. On the Continent trials have been made with the alcoholic extract of *D. rotundifolia* in cases of phthisis with apparently favourable results, while some physicians have remarked that it is too acrid, drying and hot to be serviceable for internal use. Homeopaths consider that in pathogenic doses it causes a spasmodic cough resembling pertussis. The Vytians use the Drosera for reducing gold to powder. The plants are ground to a paste, which is made to cover a sovereign and then enclosed in two small pieces of an earthern pot cemented together with cloth and clay. When dry the whole is placed in the centre of a pile of *verat-ties* (dried cowdung) and thoroughly burnt. After cooling the gold is found reduced to powder, and is given in grain doses with ghee or some confection twice a day as an antisyphilitic, alterative and tonic. Droseras are said to curdle milk, but a cold infusion of this plant does not so act.

Description.—*Drosera peltata* is a delicate little plant, of about 3 to 12 inches in height, with subterminal racemes bearing white flowers; leaves long petioled, lunate peltate, and arising from the stem as well as the root. The plants dried upon paper, cloth or wood stain them with a deep-red colour.

The powder of the freshly dried herb is dark olive green, and has the odour of sour milk.

Chemical composition.—The dried and powdered plants exhausted with alcohol afforded 26·3 per cent. of a deep red brittle residue; the portion of this extract insoluble in water consisted of a crystallizable colouring matter associated with resinous substances. By treatment of the powder directly with ether the colouring matter was removed in a pure condition and in a crystalline form of yellowish-brown prisms. These crystals were slightly soluble in boiling water and acetic acid, and more readily in strong alcohol, benzol, chloroform and ether. The crystals melted above the boiling point of water, and heated on platinum foil gave off green fumes, which condensed on a cool surface as a yellow crystalline sublimate. The solution in alkaline liquids was deep violet red, discharged by acids; and a dye bath of the powder in which some silk was immersed produced a fast rich brown tint. There can be little doubt that this colouring matter is related to that obtained by Rennie from the root of *D. Whittakeri* growing in Australia. The result of Rennie's investigation was the separation and analysis of two pigmentary principles of a crystalline nature. The one less soluble in alcohol had the formula $C^{11}H^{8}O^{5}$, which represents a trihydroxymethylnaphthaquinone, and the other more soluble had a lower melting point (164-165°) and an empirical formula $C^{11}H^{8}O^{4}$. The absorption spectrum of the alkaline solution of the former body shows the violet, while that of the latter shows only the red. The blistering property appeared to reside in a resin. The powdered herb left when ignited 11·13 per cent. of reddish ash, containing much iron in the ferric state.

HAMAMELIDEÆ.

LIQUIDAMBAR ORIENTALIS, *Miller.*

Fig.—*Bentl. and Trim.*, *t.* 107. Liquid Storax (*Eng.*), Styrax liquide (*Fr.*).

Hab.—Asia. The balsam.

Vernacular—Silaras (*Ind*), Neri-arishippál (*Tam.*), Shilarasam (*Tel.*).

History, Uses, &c.—Liquid storax is prepared in the South Western Districts of Asia Minor by boiling the inner bark of the tree in water and pressing it; a superior kind is said to be obtained by simply pressing the bark before it is boiled. We learn from the author of the Periplus of the Erythrean Sea that as long ago as the first century storax was exported *via* the Red Sea to India.

About this time Silhaka (Silaras) is mentioned as one of the imports at the port of Thana on the Western Coast. It was carried first to this country and afterwards to China by Arab traders in the same manner as myrrh, olibanum, and other odoriferous drugs. Upon the decline of the port of Thana the trade was transferred to Surat, then to Goa, and afterwards to Bombay, where it still continues, the imports averaging from 350 to 360 cwts. yearly. In the trade statistics of the early European traders it is called Rosa Mallas and Rosa Malloes, a name which it still retains, and the origin of which is doubtful, though some suppose it to be identical with Rasamála, the Malay name for *Altingia excelsa*. That the latter supposition is incorrect we think there can be little doubt, as the only Rose malloes known in Bombay is that imported from Europe. The following extracts will, we think, show that the name is of European origin, and has been applied to Liquid Storax incorrectly through a confusion of that substance with the Honey dew or Manna collected from trees, the δροσόμελι of the Greeks and the Ros melleus of the the Middle Ages. Galen, speaking of δροσόμελι says:—"I have sometimes known in summer a large quantity of honey to be found upon the leaves of trees, shrubs and certain herbs."

Ibn Baitar, on the authority of Hubaish, says:—"Rasimilius is a substance which falls upon trees in Khorasan; it is useful in fevers, it moistens the chest, is detergent, &c." The author of the *Makhzan* says:—"Rasimilius is a Greek name for a kind of incense called in Arabic دخان الضرو (Dukhán-el-daru), and

in Hindi अस्त लोबान (Ast lobán) or Western Frankincense." In another place, speaking of Daru, he says that the Greek name is Fazukus (ζυγος) ?.

According to Abu Hanífeh "ضرو (*Liquidambar orientalis*) is of the trees of the mountains, and is like the great oak, having clusters (of berries) like those of the oak, but its berries are larger; its leaves are cooked, and when thoroughly cooked, are cleared away and the water thereof is returned to the fire, and coagulates, becoming like 'Kubaita' (a kind of sweetmeat), and is used medicinally us a remedy for roughness of the chest, and for pain of the fauces." The author of the Tuhfat-el-Muminín says:—"ضرو Darú or Zarú is the name of an Arabian tree like the oak; its fruit is like that of the بطم Butm (*Pistacia Terebinthus*), but its seeds are larger; the gum of this tree is storax (*Hassi luban*), and has already been noticed. The wood, leaves and fruit are hot and dry, and a decoction with sugar, when brought to the consistence of a syrup by boiling, is used for roughness of the throat and cough. The oil of the seeds is odoriferous and dissolves phlegmatic humours; it is useful in dyspepsia, and in the scabby eruptions of animals." In India it is always called Siláras, and is noticed in Sanskrit works as Silhaka, and described as a product of Turkey. The Hindus use it chiefly for perfuming medicinal oils, but are aware of its pectoral qualities, and occasionally prescribe it. In modern Arabic and Persian works Liquid Storax is called Meahsayelah and Lubní, and is described as the gum or juice of a tree resembling the quince. Three kinds are generally mentioned—viz., 1*st*, that which exudes naturally; 2*nd*, that which is obtained by pressing the bark, and 3*rd*, that which is obtained by boiling it. These three kinds, however, are not at the present time distinguished in commerce in Bombay, though the article may vary in quality considerably. Storax is considered by the Mahometans to be tonic, resolvent, suppurative, and astringent; it is prescribed as a pectoral, and is thought to strengthen all the viscera; applied externally it is supposed to have a similar action upon the parts with which it comes in contact. It is

a favourite application to swellings, and in India is much used in orchitis, the inflamed part being smeared with it and then bound up tight in tobacco leaves. The Burmese Storax noticed in the *Pharmacopœia of India* is not known in India. Much interesting information regarding the history and sources of Storax may be found in the *Pharmacographia*.

Description.—We have examined the liquid storax of the Bombay market, and find that it agrees with the description of the drug given by Flückiger and Hanbury, which is as follows:—"It is a soft viscid resin, usually of the consistence of honey, heavier than water, opaque and greyish brown. It always contains water, which by long standing rises to the surface. In one sample that had been kept more than 20 years, the resin at the bottom of the bottle formed a transparent layer of a pale golden brown. When liquid storax is heated, it becomes, by the loss of water, dark brown and transparent, the solid impurities settling to the bottom. Spread out in a very thin layer it partially dries, but does not wholly lose its stickiness. When free from water (which reddens litmus) it dissolves in alcohol, spirit of wine, chloroform, ether, glacial acetic acid, bisulphide of carbon, and most of the essential oils, but not in the most volatile part of petroleum (petroleum ether)." It has a pleasant balsamic smell, especially after it has been long kept; when recent, it is contaminated with an odour of bitumen or naphthalin, that is far from agreeable. Its taste is sharply pungent, burning and aromatic.

"When the opaque resin is subjected to microscopic examition, small brownish granules are observed in a viscid, colourless, transparent liquid, besides which large drops of a mobile watery liquid may be distinguished. In polarized light, numerous minute crystalline fragments with a few larger tubular crystals are obvious. But when thin layers of the resin are left on the object-glass in a warm place, feathery or spicular crystals (styracin) shoot out on the edge of the clear liquid, while in the large, sharply-defined drops above mentioned, rectangular tables and short prisms (cinnamic acid) make

their appearance. On applying more warmth after the water is evaporated, all the substances unite into a transparent, dark brown, thick liquid, which exhibits no crystalline structure on cooling, or only after a very long time. Among the fragments of the bark occurring in the crude resin, liber fibres are frequently observable.

Chemical composition.—E. Simon (1839) obtained from this balsam styrol, cinnamic acid, styracin, and two resins. In addition to these, W. von Miller (1876-77) found a little benzoic acid, cinnamic ethyl, and a fragrant compound melting at 65° C., probably ethyl vanillin; in larger proportion were found the alcohol storesin in two modifications—the cinnamic ether of this alcohol and cinnamate of phenylpropyl. *Styrol* or *cinnamene* has the composition C^8H^8, and is obtained by distilling storax with water. The yield is very variable. It is a colourless, thin liquid, very refractive to light, and of a very fragrant odour and burning taste. It has been artificially obtained by heating acetylene gas, and from ethyl-benzol bromide by heating it with baryta. Its specific gravity is 0·924, and it boils at 146° C.; but when heated to 200° C. it is rapidly converted into a polymeric compound, *metacinnamene*, which is a colourless, amorphous, tough solid of the specific gravity 1·054, insoluble in alcohol and ether, and reconverted into styrol when distilled. *Cinnamic acid* may be obtained by treating storax with a solution of sodium carbonate and precipitating the acid by means of hydrochloric acid. The ethers are obtained from storax previously deprived of cinnamic acid by treating it with hot petroleum benzin, on the cooling of which white or colourless needles are deposited which require repeated treatment with hot benzin. *Styracin* melts at 38° C., and after prolonged heating congeals to a transparent mass, in which crystals are formed very slowly. It is *styryl (cinnamyl) cinnamate*, $C^9H^9C^9H^7O^{27}$, and when in alcoholic solution treated with caustic soda, or when heated with an aqueous solution of soda, is converted into cinnamate of sodium and *cinnam-alcohol*, also known as *styryl alcohol* and *styron*, $C^9H^{10}O$. This crystallizes in colourless silky needles, has an

agreeable hyacinthine odour, melts at 33° C., and boils at 250° C. Styracin and cinnamic acid yield with oxidizing agents oil of bitter almonds and benzoic acid, and when styrol is treated with chromic acid and then boiled with water, benzoic acid is obtained. After saponifying storax with an alkali, and subjecting the alcohols to fractional distillation, Laubenheimer (1872) obtained a distillate having the properties of *benzyl alcohol*; this is a colourless liquid of a weak but fragrant odour having the specific gravity 1·06 and the composition C^7H^8O. *Storesin*, $C^{36}H^{58}O^3$, is amorphous, melts at 168° C. (β storesin at 145° C.), and dissolves readily in alcohol, ether, petroleum, benzin, and potassa, forming with the latter a crystalline compound. Mylius (1882) prepared *styrogenin*, $C^{26}H^{40}O^3$, from that portion of storax which is soluble in boiling benzin; after treating it with an equal weight of sulphuric acid, boiling with water, and washing with ether, white crystals are left which are easily soluble in chloroform, melt at 350° C., dissolve in cold sulphuric acid, being reprecipitated by water, and yield with warm sulphuric acid a yellowish-red solution, which with water precipitates uncrystallizable resin. (*Stillé and Maisch.*)

Commerce.—The imports of this article into Bombay in 1881-82 amounted to 363 cwts. from the Red Sea ports. Value, Rs. 16,154. In India it is often adulterated with coal tar.

Under the name of **Usturak** (στυραξ), a bark is sometimes found in the Indian drug shops; it is said to be imported from Turkey, and occurs in half quills several inches long, of a light brown colour, the external surface soft and corky, but the inner portion resinous and aromatic; it is probably the bark of *Storax officinalis*, Linn., the tree which produced the storax of the ancients. (*Cf. Pliny* xii. 55.)

RHIZOPHOREÆ.

These are maritime trees or shrubs popularly called Mangroves. Dr. William Hamilton has published an interesting

account of them in the *Pharmaceutical Journal*, from which we extract the following:—

"In the economy of Nature the Mangrove performs a most important part, wresting annually fresh portions of the land from the dominion of the ocean, and adding them to the domain of man. This is effected in a twofold manner: by the progressive advance of their roots, and by the aërial germination of their seeds, which drop into the water with their roots ready prepared to take possession of the mud, in advance of their parent stems. The progression by means of the roots is effected by fresh roots, which issue from the trunk at some distance above the surface of the water, and arching downwards penetrate the mud, establishing themselves as fresh plants. Mangrove bogs are certain indicators of a malarious locality, inasmuch as they prevent the escape of unhealthy miasmata."

Rheede (*Hort. Mal. vi., tt.* 33, 34, 35,) figures **Bruguiera caryophylloides, Rhizophora mucronata**, and **Kandelia Rheedii**, and mentions their medicinal use on account of the astringency of their juices. All of these plants are known as Kandel in Malabar, the Portuguese call them Salgeira, and the Dutch Runboom. They contain abundance of tannin, and are used in India by tanners. With salts of copper and iron they yield olive-brown, rust and slate-coloured tints, and are consequently employed in dyeing.

END OF THE FIRST VOLUME.

PHARMACOGRAPHIA INDICA.

A

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HISTORY OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN,

MET WITH IN

BRITISH INDIA.

BY

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PRINCIPAL MEDICAL STOREKEEPER TO GOVERNMENT,

C. J. H. WARDEN,
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AND

DAVID HOOPER,
QUINOLOGIST TO THE GOVERNMENT OF MADRAS,
OOTACAMUND.

PART II.

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PHARMACOGRAPHIA INDICA.

COMBRETACEÆ.

TERMINALIA CHEBULA, *Retz.*

Fig.—*Roxb. Cor. Pl., t.* 197; *Bedd. Fl. Sylv. t.* 27; *Gärtn. Fruct.* ii., *t.* 97. Chebulic myrobalan (*Eng.*), Myrobalan Chébule (*Fr.*).

Hab.—India (table lands). The fruit.

Vernacular.—Har, Hara (*Hind.*), Hirada (*Mar.*), Kaduk-kai (*Tam., Mal.*), Hora, Haritaki (*Beng.*), Karakkaya (*Tel.*), Alalekay (*Can.*), Harade (*Guz.*), Hana (*Pahari*), Silim-kung (*Lepcha*).

History Uses, &c.—There are several varieties of this tree, some of which have probably been produced by cultivation. *T. citrina*, Roxb., is considered by some to be a separate species. Dutt (Hindu Materia Medica) informs us that Chebulic myrobalans, in Sanskrit *Haritaki, Abhaya,* and *Pathyá,* were highly extolled by the ancient Hindus as a powerful alterative and tonic. They have received the names of *Pranada* or life-giver, *Sudha* or nectar, *Bhishakpriya* or Physician's favourite and so forth.* A mythological origin has also been attributed to the tree. "It is said that when Indra was drinking *amrita* in heaven a drop of the fluid fell on the earth and produced the plant." On this account it is called *Shakra-srishtá* "created

* The following are the synonyms of Haritaki in the Raja-nirghanta:—Har, Sivá, Pathyá, Chetakí, Vijayá, Jayá, Pramatthyá, Pramathá, Amoghá, Káyasthá, Pránadá, Amritá, Jivaniyá, Hemavati, Pútaná, Brantaná, Abhayá, Javasthá, Nandini, Sreyasi, Rohini. In Sankrit prescriptions any one of these names may be used.

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by Indra." Indian writers describe seven varieties of Haritaki, which however are nothing more than the same fruit in different stages of maturity. Very large fruit are considered particularly valuable, and fetch a fancy price. Chebulic myrobalans are considered to be laxative, stomachic, tonic, and alterative. They are prescribed alone or in combination with Emblic and Beleric myrobalans in a vast number of diseases, chiefly those affecting the chest and abdomen. The three myrobalans together are called *triphala* or the *three fruits* in Sanskrit. Various original receipts for their administration will be found in Dutt's Hindu Materia Medica. Myrobalans were known to the early Arabian writers, and through them to the Greek writer Actuarius, who mentions five kinds. Nicolas Myrepsicus also notices them. The author of the Makhzan-el-Adwiya, on the subject of chebulic myrobalans, says that the very young fruit, about the size of cumin seeds, are called *Halileh-i-zira;* when about the size of a grain of barley, *Halileh-i-jawi;* when of the size of a raisin, *Halileh-i-zangi* or *Halileh-i-hindi*; when half arrived at maturity and yellowish, *Halileh-i-chini;* when still further advanced, *Halileh-i-asfar;* and lastly, when quite mature, *Halileh-i-kabuli.* Of these six varieties of chebulic myrobalans, the second, third, and last only are in general use for medicinal purposes, the fourth and fifth, also known as *Rangári har* or *hirade,* are chiefly used by tanners. The Mahometans, like the Hindus, attribute a great many fanciful properties to the drug; shortly, we may say, that the ripe fruit is chiefly used as a purgative, and is considered to remove bile, phlegm, and adust bile; it should be combined with aromatics, such as fennel seeds, caraways, &c. The Arabs say,—"*Ihlilaj* is in the stomach like an intelligent housewife, who is a good manager of the house." The unripe fruit (*Halileh-i-hindi* or *Himaja*) is most valued on account of its astringent and aperient properties, and is a useful medicine in dysentery and diarrhœa; it should also be given with aromatics. Locally it is applied as an astringent. The first and second kind are supposed to have the same properties as the third in a less degree, and the fourth and fifth the same as the sixth in

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a less degree. The best way of administering myrobalans as a purgative is to make an infusion or decoction of from 2 to 4 drachms of fruit pulp with the addition of a pinch of caraway seeds and a little honey or sugar.

Ainslie notices their use as an application to aphthæ. In the *Pharmacopœia of India,* Dr. Waring mentions his having found six of the mature fruit an efficient and safe purgative, producing four or five copious stools, unattended by griping, nausea or other ill effects; probably those used by him were not of the largest kind. Dr. Hové in his account of a visit to the Myrobalan Plantation at Bungar in the Concan in 1787, states that he found one fruit a sufficient purgative, though the manager of the plantation told him that two were generally used. Twining (*Diseases of Bengal,* Vol. I., p. 407,) speaks very favourably of the immature fruit (*Halileh-i-zangi*) as a tonic and aperient in enlargements of the abdominal viscera. We have found them a useful medicine in diarrhœa and dysentery, given in doses of a drachm twice a day. Recently, *M.* P. Apéry has brought to the notice of the profession in Europe the value of these black myrobalans in dysentery, choleraic diarrhœa, and chronic diarrhœa; he administers them in pills of 25 centigrams each, the dose being from 4 to 12 pills or even more in the 24 hours. (*Journ. de Pharm. et de Chim.* Feb. 1st, 1888.) Roxburgh states that the tender leaves, while scarce unfolded, are said to be punctured by an an insect, and its eggs deposited therein, which by the extravasation of the sap, become enlarged into hollow galls of various shapes and sizes, but rarely exceeding an inch in diameter. They are powerfully astringent, and make as good ink as oak galls. They also yield the chintz painters on the coast of Coromandel their best and most durable yellow. They are called by the Tamils *Kadu-cai-pu,* and by the Telingas *Aldicai,* (*Fl. Ind.* II., 435.) In the *Pharmacopœia of India* they are noticed on the authority of the Rev. J. Kearns of Tinnevelly as a valuable astringent in diarrhœa. The Himalayan tribes eat the kernels of this myrobalan, and use the fruit as a remedy for sore throat under the name of *Khoki.*

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Description—The mature myrobalan is of on ovoid form, from 1—1½ inches long, sometimes tapering towards the lower extremity, obscurely 5 or 6-sided, more or less furrowed longitudinally, covered with a smooth yellowish brown epidermis, within which is an astringent pulp, enclosing a large rough bony, one-celled endocarp.

The unripe fruits are shrivelled, black, ovoid, brittle bodies, from ⅓ to ⅝ of an inch in length, having a shining fracture and an astringent taste; on careful examination the rudiments of the nut may be distinguished.

Chemical composition.—According to Stenhouse (1843), chebulic myrobalans contain about 45 per cent. tannin, also gallic acid, mucilage and a brownish yellow colouring matter. Hummel has obtained 31 per cent. of tannic acid, and Paul 32·82, and 26·81 of gallotannic acid from two ordinary samples of the commercial article, but from a sample of inferior quality only 6·11 per cent.

Herr Fridolin (1884) reported to the Dorpat Naturforscher Gesellschaft the isolation from chebulic myrobalans of a new organic acid, which he has named *chebulinic acid*, and considers to be probably the source of the gallic and tannic acids detected by previous observers. He obtains it by saturating an aqueous solution of an alcoholic extract of the fruit with sodium chloride, dissolving the matter that separates in water, and shaking the solution with acetic ether, which takes up the chebulinic acid together with tannic acid. The residue after the evaporation of the ether is dissolved in a little water and allowed to stand for a few days, when the chebulinic acid crystallizes out in rhombic prisms. The acid, which is odourless and sweet, dissolves very readily in alcohol and hot water, not so freely in ether, and with great difficulty in cold water, the solutions having an acid reaction. In aqueous solution the chebulinic acid reduces Fehling's solution, and in some of its reactions it closely resembles gallic acid, but differs from it in affording no colour reaction with potassium cyanide. Herr Fridolin suggests as a formula probably representing its composition, $C^{28} H^{24} O^{19}$. ($C^7 H^6 O^5$?) When decomposed

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by heating an aqueous solution in a closed tube, chebulinic acid takes up the elements of water, and the molecule is split up into two molecules of gallic acid and one of tannic acid. Herr Fridolin suggests the possibility of the existence in other instances of an organic compound splitting up into tannic and gallic acids.

According to *M.* P. Apéry, black myrobalans contain an oleo-resin of a green colour soluble in alcohol, ether, petroleum spirit and oil of turpentine; this oleo-resin, which has been named by him *myrobalanin,* is coloured red by nitric acid. (*Journ. de Pharm. et de Chim.*, Feb. 1st, 1888.)

Commerce.—See next article. Very large chebulic myrobalans are sold in the bazars as Sarvári or Sardári har, and often fetch a rupee each. Fictitious myrobalans of very large size are manufactured by glueing slices of the pulp upon a natural fruit.

TERMINALIA BELERICA, *Roxb.*

Fig.—*Bedd. Fl. Sylv., t.* 19; *Wight Ic., t.* 91; *Rheede Hort. Mal. iv., t.* 10. Beleric myrobalan (*Eng.*), Myrobalan beléric (*Fr.*).

Hab.—India.

Vernacular.—Bahera, Bharla, Balra (*Hind.*), Bahera, Bohora (*Beng.*), Behada, Vahela (*Mar.*), Tánrik-kay, Thani (*Tam.*), Tándra-káya (*Tel.*), Tári-káyi (*Can.*).

History, Uses, &c.—This tree, in Sanskrit Vibhita and Vibhitaka (fearless), is avoided by the Hindus of Northern India, who will not sit in its shade, as it is supposed to be inhabited by demons. Two varieties of *T. belerica* are found in India, one with nearly globular fruit. ½ to ¾ inch in diameter, the other with ovate and much larger fruit. The pulp of the fruit (Beleric myrobalan) is considered by Hindu physicians to be astringent and laxative, and is prescribed with salt and long pepper in affections of the throat and chest. As a constituent of the *triphala* (three fruits), *i.e.*, emblic, beleric and chebulic

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myrobalans, it is employed in a great number of diseases, and the kernel is sometimes used as an external application to inflamed parts. On account of its medicinal properties the tree bears the Sanskrit synonym of Anila-ghnaka, or "wind-killing." According to the Nighantás the kernels are narcotic. Mahometan writers describe Balilaj (the beleric myrobalan) as astringent, tonic, digestive, attenuant, and aperient, and useful as an astringent application to the eyes. As long as the doctrines of the Arabian school prevailed, myrobalans were used medicinally in Europe, having been introduced by the Arabs from India. The μυροβαλανος of the classical Greek and Latin writers was a fruit from which the perfumers obtained oil for their unguents. According to Theophrastus, the outer cortical portion was pounded to extract the oil, as that part only was sweet smelling. It is uncertain what this fruit was, but it appears to have been something similar to that of the African oil palm (*Elæis guineensis*), the outer fleshy coating of which yields an oil of the consistence of butter, having a rather pleasant violet-like odour when fresh. The later Greek physicians apply the terms μυροβαλανος and μυρεψικος to Indian myrobalans.

T. belerica produces a quantity of gum of the Bassora type, which is collected and mixed with soluble gums for sale as country gum.

Description.—The fruit of the smaller variety of this myrobalan is nearly globular, and suddenly narrowed into a short stalk, it is from ½ to ¾ inch in diameter, fleshy, covered with a close fulvous tomentum; the stone is hard and pentagonal, and contains a sweet oily kernel, having three prominent ridges from base to apex. In the larger variety the fruit is ovoid and about double the size, and the flowers have a powerful stercoraceous odour exactly resembling that of the wood of *Celtis reticulosa* in which W. A. Dunstan has demonstrated the presence of skatole. The gum is mostly in vermicular pieces of a yellowish-brown colour; in water it forms a bulky gelatinous mass of insipid taste.

Chemical composition.—The percentage of tannic acid in these myrobalans appears to vary considerably. Hummel ob-

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tained 17·4 per cent.; he remarks that the fruit consists of two distinct portions, an outer and inner; 100 parts contains 75·4 per cent. outer, and 24·6 per cent. inner. The inner portion only contains 1·25 per cent. of tannic acid. Paul obtained from two commercial samples of beleric myrobalans 5·03 and 6·70 of gallotannic acid. (*Watt., Selections from the Records of the Govt. of India*, Vol. I., pp. 83 and 93.) We have examined the pulp of the smaller myrobalan removed from the shell enclosing the kernel, and the kernels separately, with the following results:—

	Pulp.	Kernel.	
Moisture	8 00	11·38	per cent.
Ash	4·28	4·38	„
Petroleum ether extract ...	·12	29·82	„
Ether extract	·41	·61	„
Alcoholic „	6·42	·61	„
Aqueous „	38·56	25·26	„

Pulp.—The moisture was determined by heating to 100° C. the finely powdered material. The ash contained no manganese.

The petroleum ether extract consisted of greenish yellow oil.

The ethereal extract contained colouring mattter, resins, a trace of gallic acid, and oil. No alkaloid was present.

The alcoholic extract was yellow, brittle, and highly astringent. In warm water it was partly soluble. The aqueous solution gave the following tannin reactions: with ferric chloride indigo-blue, changing to damson on the addition of ammonia; with lime water a light yellow precipitate, turning greenish blue on adding an excess; with bichromate of potash a dirty reddish brown precipitate; with bromine water no precipitate; with sulphate of copper a slight precipitate; on adding ammonia a dense nearly white precipitate, rapidly becoming yellow and then yellowish brown. No alkaloidal principle was detected.

Kernels.—The moisture was determined first by exposure over sulphuric acid in a vacuum: and then at 100° C. The ash contained no manganese.

The petroleum ether extract consisted of a pale yellow, thin, nutty flavoured oil, non-drying, and insoluble in alcohol; on

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standing no crystalline deposit was formed; there was nothing specially noteworthy regarding its colour reactions. No alkaloidal principle was detected. The ethereal extract was whitish and oily; in light petroleum ether ·52 per cent. was soluble, which added to the petroleum ether extract, would increase the oil content of the kernels to 30·44 per cent.; the residue insoluble in light petroleum ether amounted to ·09 per cent., and did not afford reactions for alkaloidal principles. Brannt states that the oil behaves in the same manner as mastic oil when obtained by expression, and he describes it as a green fluid oil, from which a white fat of the consistence of butter separates.

The alcoholic extract was whitish and partly soluble in hot water with acid reaction, tasteless; no alkaloid was detected.

The aqueous extract did not reduce an alkaline copper solution until after boiling with a dilute acid. The extract was specially examined for saponin with negative results.

The powdered air-dried bark of the large variety of *T. belerica* contained 3·71 per cent of moisture, and 18·61 per cent of ash, in which no trace of manganese could be detected.

With the exception of astringent matter, giving a brownish coloration with ferric salts, nothing of special importance was detected in either the bark or leaves—no alkaloids or glucosides were detected. An alcoholic extract, after separation of the alcohol, obtained from 10 grams of the bark injected into a cat's stomach, afforded the following symptoms:—

Injected at 10-50 a. m. into a cat's stomach which had fasted for about 10 hours.

11-15. Vomited twice.
11-25. Solid motion.
11-45. Vomited.

No further symptoms were noted, and the following day the cat appeared to be in its normal condition.

In the case of the leaves an alcoholic extract induced almost immediate vomiting without any other symptoms.

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In neither of the experiments was there heaviness, inability to move, or any symptoms of intoxication noticed.

Toxicology.—Roxburgh and Graham notice the popular belief that certain trees of *T. belerica* bear fruit the kernels of which have intoxicating properties; these trees are said by some to be always those of the large fruited variety. Native evidence on this point is conflicting, some people say that they have eaten both kinds of the seeds freely without experiencing any narcotic effects, but that when water is taken after eating them giddiness and a sense of intoxication is experienced. If vomiting occurs these symptoms soon pass off. There is no doubt that children often spend many hours under these trees eating the seeds, and it is quite possible that severe attacks of indigestion may follow such excesses.

The only cases of poisoning by the Bahira have been recorded by Mr. Raddock, Sub-Assistant Surgeon in charge of the Malwa Bheel Corps. Three boys, from five to nine years of age, picked up and ate some of the dry nuts near the house of a Chamar, who had brought them from the jungles for the purpose of colouring leather. Two of these boys, became drowsy, complained of headache and sickness at stomach, and vomited freely a thick white frothy mucus. The third, a rather weakly boy of seven, was first seen by Mr. Raddock on the following morning. He was in his father's lap, and appeared as if asleep; the legs and arms were relaxed and bent; eyes closed, breathing soft. There was total insensibility; and shaking and calling did not make him stir in the least, or answer. The pulse was scarcely perceptible, action of the heart frequent and weak. Body of natural warmth, legs cold, eyes rather glistening, pupils fixed, neither contracted nor dilated, jaws closed, and only to be opened by much force. This child had eaten the largest quantity of kernels—between 20 and 30. At the time, or subsequently, nothing was complained of. He played all day and at night before going to bed; went to sleep, and was not noticed until next morning, when he was found insensible, and was supposed to be dead. With difficulty he was made to vomit

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three or four times, the eyes opened with a heavy dull expression, and closed again; though he relapsed his condition was now improved, the insensibility was not so deep, and his hand was moved to his throat. Small quantities of strong black tea were administered. About 10 a. m. he became sensible, opened his eyes, and answered, when spoken to; towards the afternoon he walked about and improved greatly. At 5 in the evening he was sensible but drowsy, pulse small and rapid, complained of being giddy, had vomited twice since morning, with relief to the symptoms. His recovery was speedy. Mr. Raddock justly infers from these cases that the Bahira is a mild narcotic poison. In the last mentioned case he is convinced that it would have proved fatal had the stomach-pump not been used, or had emetics failed. He adds that, in two of the boys who ate about the same quantity, no effects were produced till about eight hours after, and the poison was got rid of by vomiting. In the third, who ate the most, no effects were produced in 12 hours; at least no vomiting resulted, and during sleep, insensibility came on.

Dr. Burton Brown in citing this case says that *Terminalia belerica* is sometimes added to spirit in bazaars, in conjunction with the Chebulic myrobalan (*hara*) and the Emblic myrobalan (*avola*), so that it is possible that an accident might occur from the use of spirit so drugged.

Royle and Birdwood merely say that the seeds of the *Terminalia belerica* are eaten as nuts. O'Shaughnessy, however, adds that they "are deemed intoxicating." (*Chevers.*)

As regards the seeds eaten in moderation, our experiments lead to the conclusion that they are perfectly harmless; one of us has eaten kernels without any ill effects. In one of our experiments we injected into a cat's stomach an alcoholic extract from 9 grams of the kernels with negative results. In another experiment we mixed 13·2 grams of kernels, equal to about 35—40 kernels, reduced to a fine pulp, with about 30 grams of raw meat, also pulped: this mixture was readily eaten at 11·5 a. m. by a cat which had been fasting for many hours:

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when the laboratory was closed at 4 p. m. the cat appeared in its usual condition, no symptoms having been induced, and on the following morning it appeared to be perfectly well. We learn that Jogis consider that one kernel eaten daily increases the appetite for sexual indulgence. Our experiments appear to be fairly conclusive that these kernels do not possess any toxic properties.

Commerce.—Myrobalans are one of the principal forest products of India; they are collected in large quantities on Government account, and yearly auctions are held by the Forest Conservancy Department. Both chebulic and beleric myrobalans are largely exported for tanning and dyeing. The exports from the whole of India were:—In 1885-86, 706,000 cwts., valued at 30 lakhs of rupees; in 1886-87, 597,000 cwts., valued at 23 lakhs of rupees; in 1887-88, 678,000 cwts., valued at 25 lakhs of rupees.

TERMINALIA ARJUNA, *Bedd.*

Fig.—*Fl. Syl.*, *t.* 28; *D C. Mem. Combr. t.* 2.

Hab.—Deccan, Ceylon, North-West Provinces. The bark.

Vernacular.—Kahu, Arjun (*Hind.*), Vellai-maruda-maram (*Tam.*), Tella-maddi-chettu (*Tel.*), Arjun, Shárdul, Pinjal (*Mar.*), Arjun (*Beng.*), Tora-billi-matti (*Can.*).

History, Uses, &c.—This tree is the Arjuna and Kukubha of Chakradatta, who describes it as tonic, astringent, and cooling, and prescribes it in heart disease and for those purposes for which astringents are generally applied. He recommends it to be given in milk, treacle or water when used internally, or as a *ghrita* (medicinal butter) made with the decoction and powder of the bark.

Hindu physicians think that the bark has some special virtue in promoting the union of fractures, and the dispersion of ecchymosis when given internally. It is considered to be *Asmari-hara*, or lithontriptic, and a reference to the chemical composition will show that the ash of the bark contains an

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extraordinarily large proportion of calcium carbonate. Externally it is used in the form of an astringent wash to ulcers.

Descrpition.—The bark is generally sold in short hlaf quills, frcm $\frac{1}{8}$ to $\frac{3}{8}$ of an inch thick and several inches long; it has a pinkish colour, which is seen through the thin grey epidermis; its substance is fibrous and gritty under the teeth; it breaks with a short fracture, the internal surface being of a lighter colour and finely striated. The taste is agreeably astringent. The bark when magnified shows remarkably large cells in the medullary rays, and numerous large stone cells of a bright yellow colour contrast strikingly with the pinkish tinge of the other structures. It contains much crystalline matter.

Chemical composition.—This is most remarkable, the ash amounts to 34 per cent. of almost pure calcium carbonate, which if calculated into oxalate would amount to 43·5 per cent. The watery extract is 23 per cent. with 16 per cent. of tannin; very little colouring matter besides the tannin is extracted by alcohol. The tannin gave a blue-black precipitate with ferric salts.

ANOGEISSUS LATIFOLIA, *Wall.*

Fig.—*Bedd. Fl. Sylv., t.* 15; *Royle Ill., t.* 45; *Wight Ic., t.* 994.

Hab.—Himalayas to Ceylon. The gum and leaves.

Syn.—*Conocarpus latifolia.*

Vernacular.—Dháoya, Dhaura, Dhava, Bakla (*Hind*), Davda (*Guz., Mar.*), Vallai-naga, Vakkali (*Tam.*), Chiriman, Yellamaddi (*Tel.*), Dinduga (*Can.*).

History, Uses, &c.—A large and very common tree called in Sanskrit Dhava, Dhavala, Madhura-tvacha and Vaka-vriksha, or "crane tree," on account of the resemblance of its fruit to the head of a crane (vaka). The wood is hard but not durable; it affords a good fuel and excellent charcoal. The tree is remarkablo for the large amount of gum which

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flows from it, whence the Sanskrit name Dhava, from धव, to flow. The gum has a great reputation in India among calico-printers for use with certain dye-stuffs, such as turmeric. The leaves are used in most parts of the country for tanning.

Description.—Leaves short petioled, ovate, generally emarginate, entire, smooth, from one to four inches long, and from one and a half to two broad. Taste very astringent. In the variety *villosa* the leaves are rusty villose on both surfaces, and in the variety *parvifolia* they are very small and silky pubescent. For a description of the gum the reader is referred to the article upon the *Substitutes for Gum Acacia,* Vol. I., p. 544.

Chemical composition.—The leaves have been examined by Hummel, who obtained from them a pale yellow decoction, and 15·5 per cent. of tannic acid. (*Watt, Selections from the Records of the Govt. of India* Vol. I., p. 93.) Lyon, who has also examined them, obtained a similar result.

QUISQUALIS INDICA, *Linn.*

Fig.—*Lam. Ill., t.* 357; *Wight Ill., t.* 92; *Bot. Reg. N. S. XXX., t* 15. Rangoon creeper (*Eng.*), Liane vermifuge (*Fr.*).

Hab.—Malaya. India, cultivated. The seeds.

Vernacular.—Rangun-ki-bel(*Hind.*),Vilayati-chameli(*Mar.*), Irangun-malli (*Tam.*), Rangunu-malle-chettu (*Tel.*).

History, Uses, &c.—In the Moluccas the seeds have long been held in repute as an anthelmintic, and in 1833 they were brought forward by Dr. Oxley and Mr. Gordon of Singapore. (*Calcutta Med. and Phys. Trans.*, vii., p. 488.) The testimony adduced in their favour by these authorities is strong, and is to the effect that in cases of *lumbrici,* four or five of these seeds, bruised and given in electuary with honey or jam, suffice for the expulsion of the entozoa in children. Bouton (*Med. Plants of Mauritius,* p. 58), who gives *Liane vermifuge*

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as the name of the shrub in the Mauritius, states that if more than four or five seeds are given they are apt, in some constitutions, to cause spasm and other ill effects. (*Pharm. of India.*) Loureiro states that the leaves are astringent. This plant is cultivated as a flowering shrub in most parts of India, but except in the Southern Provinces it very seldom ripens its fruit, and its medicinal properties are consequently unknown in most parts of the country.

Description.—The fruits are about an inch in length, oval or oblong, pointed at either extremity, and sharply pentagonal; they dehisce from the apex. The woody pericarp is thin, fragile and of a deep mahogany colour; it encloses a pentagonal seed nearly black when dry, yellowish and oily internally. (*Fig. in Hanbury's Science Papers, p.* 232.)

Chemical composition.—Quisqualis fruits consist of 41 parts shells and 59 parts kernels in 100 parts. The fixed oil obtained by ether amounts to 15 per cent.; it is of a yellow colour, peculiar odour, and has a specific gravity of ·9169. It yields on saponification 94·7 per cent. of fatty acids melting at 43° C. The oil with sulphuric acid passes from a reddish-brown colour through red and green to purple. The alcoholic extract, after removal of the oil, is intensely sweet owing to the presence of an amorphous fermentable sugar similar to levulose; the solution in water acidified with acetic acid and shaken with ether affords on evaporation of the ether a crystalline residue, soluble in sulphuric acid without colour, striking an orange colour with caustic soda, and giving in watery solution precipitates with the alkaloidal reagents. The drug now treated with water yields a deep reddish brown colouring matter of the nature of an organic acid. It darkens slightly with iron salts, gives no precipitate with gelatine, and is wholly removed from solution by neutral plumbic acetate, and the precipitate after standing some days remains in an amorphous condition. This aqueous extract was rendered turbid by alcohol, mineral acids and tannin solution, and decomposed when evaporated. The behaviour of the extract points to the

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presence of cathartic acid, or an analogous acid of the amidic series. The seeds afford 7 per cent. of an alkaline deliquescent ash.

CALYCOPTERIS FLORIBUNDA, *Lam.*

Fig.—*Roxb. Cor. Pl., t.* 87.

Hab.—Western India, Assam. The leaves, root, and fruit.

Vernacular.—Bandi-murududu (*Tel.*), Báguli, Ukshi (*Mar.*), Kokoranj, (*Hind.*), Marsada, Báguli (*Can.*).

History, Uses, &c.—This is a dense climbing shrub. The Marathi name Ukshi is evidently derived from the Sanskrit उक्ष, to sprinkle or moisten, as plants loving shade and moisture, such as *Naregamia alata*, flourish beneath it. The leaves are bitter and astringent, and are chewed by the natives and the juice swallowed as a remedy for colic. The root ground to a paste with that of *Croton oblongifolium* is applied to bites of the Phoorsa snake (*Echis carinata*). In *pandurog* (jaundice) ukshi fruit and various spices, of each one part, are made into a compound powder, of which the dose is two massas.

The fruit, with the root of *Grewia pilosa*, Lam., is rubbed into a paste with honey and applied to ulcers.

Description.—Leaves opposite, shortly petioled, elliptic or ovate, acuminate, entire. On the upper surface are thinly scattered long hairs which are most abundant at the edges; the under surface is rusty tomentose, the tomentum being collected in little tufts giving rise to a dotted appearance in the fully mature leaf; taste very astringent and somewhat bitter. The fruit is about ¼ inch in length, ovoid, 5-ribbed, villous, 1-seeded, and is surmounted by the enlarged calyx; cotyledons convolute.

Chemical composition.—The leaves assayed by Löwenthal's permanganate and gelatine process yield 6·86 per cent. of tannin, expressed in terms of gallo-tannic acid using Neubauer's equivalent.

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The plants of minor importance belonging to this Order, which are sometimes used medicinally, are:—

Terminalia tomentosa, *Bedd. Fl. Sylv.*, t. 17, and its variety, *T. glabra*, *Vern.*—Asan (*Hind.*), Ain (*Mar.*), Kurrupu-maruta-maram (*Tam.*), Piasal (*Beng.*), Nalla-maddi-chettu (*Tel.*), Tembavu (*Mal.*), trees common in most parts of India, have an astringent bark which is used for tanning, and has been recommended for medicinal use by Dr. Æ. Ross. Powdered and mixed with oil it is used for aphthæ. The ash of the bark contains much potash and is eaten by the natives, and the leaves are used for manuring rice fields. (*Bourdillon.*) Paul found 5·97 per cent. of tannin in the bark, and Hummel 4·0 per cent. We find that the bark of the variety *glabra* contains moisture 9·59, ash 14·94, and tannin 7·2 per cent. The alcoholic extract contained 13·9 per cent. of tannin and colouring matters precipitated by lead. The tannin gave a blue-black precipitate with ferric salts.

The flowers of **Terminalia paniculata**, *Roth.*, *Bedd. Fl. Sylv.*, *t.* 20, Maruthu (*Tam.*, *Mal.*), a tree of Malabar, the Nilgiris and Coorg, are used medicinally by the country people, pounded with the root of *Cissampelos Pareira*, as a remedy in cholera. The juice of the flowers along with that of Guava bark is administered as an antidote in poisoning by opium. If the flowers are not obtainable the bark may be used. The juice of the flowers or bark, with melted butter and rock salt, is applied externally in parotitis. The Marathi name for this tree is *Kinjal*, the Tamils call it *Maruthu* and *Vella-maruthu* or *Ola-maruthu*.

Terminalia Catappa, *Linn.*, *Bot. Mag.* 3004; *Bedd. Fl. Sylv.*, t. 18, the *Catappa* of the Malays, is now cultivated all over India, and is known as the almond tree (*Badam*) to both natives and Europeans. The fruit is an oval, compressed, smooth drupe, with two elevated grooved margins; it is about 2 inches long and of a dull purple colour when ripe, the pulp being bright purple. The nut is rough, hard and thick, and

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the kernel which is about half the size of an almond and nearly cylindrical, is in common use in Bengal, amongst Europeans under the name of "leaf nut." According to Brannt the almonds contain 28 per cent. of oil, which excels almond oil as regards flavour and mildness, and has the further advantage of keeping well. It is of a pale yellowish colour and entirely inodorous. Its specific gravity is 918 at 15° C., and it is composed chiefly of stearin and olein, the stearin separating at 5° C. The bark is astringent, and has been recommended for internal administration in the form of decoction as a remedy for gonorrhœa and leucorrhœa. (*Pharm. de St. Dominque.*) The tree yields a gum of the Bassora type.

MYRTACEÆ.

BARRINGTONIA ACUTANGULA, *Gärtn.*

Fig.—*Bedd. Fl. Sylv., t.* 204. The fruit, *Gärtn. Fruct. ii.*, 97, *t.* 101.

Hab.—Throughout India. The seeds.

Vernacular.—Hijjal, Samandar-phal (*Hind., Beng.*), Samudar-phal (*Guz.*), Samutra-pullam, Kadapum (*Tam.*), Kadamik, Kanapa (*Tel.*), Pivar, Sáthphal, Dhátriphal, Ingli (*Mar. Can.*).

History, Uses, &c.—This is an evergreen tree of moderate size, called by Sanskrit writers Hijja or Hijjala. The fruit is spoken of as Samudra-phala and Dhátriphala or "nurse's fruit," and is one of the best known domestic remedies. When children suffer from a cold in the chest, the seed is rubbed down on a stone with water and applied over the stornum, and if there is much dyspnœa a few grains with or without the juice of fresh ginger are administered internally and seldom fail to induce vomiting and the expulsion of mucus from the air passages. To reduce the enlarged abdomen of children it

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is given in doses of from 2 to 3 grains in milk. Rumphius states that the roots are used to kill fish, and this use of the bark is known in most parts of India. The fish are said to be not unwholesome.

B. racemosa, *Blume,* has similar properties, the bark, root and seed being bitter. Ainslie states that in Java and in Ternate the seeds are used for intoxicating fish. The powdered seeds of these plants induces sneezing.

Description.—The dry seeds as met with in the shops resemble a nutmeg in size and shape; externally they are somewhat rough, brown, and marked with longitudinal striæ; internally horny, hard and brittle when dry, but easily softened by immersion in water; the bulk of the seed consists of starch. Taste sweet at first, afterwards bitter and nauseous.

Chemical composition.—The active principle of these seeds appears to reside in a body allied to saponin. The aqueous solution forms a stable froth when shaken, and tastes at first sweet and afterwards bitter and acrid. This solution precipitated with barium hydrate, the precipitate collected, dissolved in hydrochloric acid, the barium removed as sulphate, and the clear liquor boiled, threw out an insoluble substance related to sapogenin, and the filtrate gave the reactions for glucose. The aqueous extract gave an immediate precipitate of a proteid nature with acids, which, dissolving to some extent when heated and separating again in the cold, resembled albumose; after removal of this proteid, the acid liquor was boiled, and the formation of a flocculent deposit and an increase in the amount of glucose were noticed, which confirmed the presence of a glucosidal body such as saponin. Rectified spirit dissolved 24 per cent. of extract containing gallic acid, sugar and some saponin; and the subsequent treatment with water removed more saponin together with gum and proteids. The remaining principles that could be identified were a fat, caoutchouc, a very large quantity of starch and cellulose, the ash consisting of alkaline and deliquescent salts.

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CAREYA ARBOREA, *Roxb.*

Fig.—*Roxb. Cor. Pl. iii.*, 14, *t.* 218; *Wight Ill.*, 99, 100; *Bedd. Fl. Sylv.*, *t.* 205. Pera brava (*Port.*), Wild Guava (*Eng.*).

Hab.—Throughout India.

Vernacular.—Kumbhi (*Hind.*, *Beng.*), Kumbha (*Mar.*, *Guz.*), Putai-tanni-maram, Arjama (*Tam.*), Kumbhia, Gonju (*Can.*), Kumbhi, Dudippi, Gavuldu (*Tel.*), Peru (*Mal.*). The dried calices, Vákumbha (*Guz.*), Bakumbha (*Beng.*).

History, Uses, &c.—*C. arborea* is a large deciduous tree, the leaves of which turn red in the cold season. It is the Kumbhi of Sanskrit writers, and appears to have been so named on account of the hollow on the top of the fruit giving it somewhat the appearance of a water-pot. The bark of the tree and the calices of the flowers are well known Indian remedies, and are valued on account of their astringent and mucilaginous properties, being administered internally in coughs and colds and applied externally as an embrocation. Rheede (*Hort. Mal. iii.*, 36,) states that wild pigs are very fond of the bark, and that it is used by hunters to attract them. An astringent gum exudes from the fruit and stem, and the bark is made into coarse cordage. (*Bourdillon.*) The Tamil name Puta-tanni-maram signifies "water-bark-tree," in allusion to the exudation trickling down the bark in dry weather.

Description.—Calyx ¾ to 1 inch, terete, campanulate, obscurely pubescent, lobes ovate, obtuse, ovules in two rows in each cell of the ovary. Fruit 2½ by 2 inches, globose, surmounted by an enlarged mouth having a depressed pit at the vertex within the calyx teeth. Bark thick, fibrous, externally ash-coloured, internally reddish when dry, the whole plant abounds with thick mucilage.

Chemical composition.—The thick red bark from old trees contained 8·7 per cent. of tannin, giving a blue-black colour with

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iron salts and containing 29 per cent of Pb O in its lead salt. The tannin was in a free state. The bark left 10·6 per cent of carbonated ash from the reduced calcium oxalate which occurred in large simple crystals in the liber.

CARYOPHYLLUS AROMATICUS, *Linn.*

Fig.—*Bentl. and Trim.*, t. 112. Clove tree (*Eng.*), Giroflier aromatique (*Fr.*).

Hab.—Moluccas, cultivated elsewhere. The flower buds and fruit.

Vernacular.—Laung (*Hind.*), Lavanga (*Mar., Can.*), Long (*Beng.*), Lavang (*Guz.*), Lavangálu, Lavanga-pu (*Tel.*), Kirámbu, Ilavangap-pu, Karuvap-pu (*Tam.*). The fruit, Narlaung (*Ind. Bazar*).

History, Uses, &c.—The clove tree is said to be indigenous only in the five small islands, which constitute the Moluccas proper, *viz.*, Tarnati, Tidori, Mortir, Makiyan and Bachian. It was afterwards introduced into other neighbouring islands, where it is now cultivated, and at a later period into Zanzibar and Pemba on the East coast of Africa. Cloves appear to have been known in China as early as B.C 266. At that time it was customary for the officers of the court to hold the spice in the mouth before addressing the sovereign in order that their breath might have an agreeable odour. (*Pharmacographia.*) It is difficult to say when they were first introduced into India, but they are mentioned by Charaka, who is considered to be the oldest Sanskrit medical writer, under the name of *Lavanga*, a name which, with various modifications, is applied to cloves all over India. They are regarded by Sanskrit writers as light, cooling, stomachic, digestive and useful in thirst, vomiting, flatulence, colic, &c., and are prescribed with other spices and with rock salt. (*Dutt's Hindu Materia Medica.*) A paste of cloves is applied to the forehead and nose

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as a remedy for colds. A clove roasted in the flame of a lamp and held in the mouth is a popular remedy for sore throat. The early Arabian writers call them Karanfal, a name evidently derived from the Indian languages of the Malabar Coast, Ceylon, and the Straits*; this name appears to us to have been the source from whence the Greeks have derived the name καρυοφυλλον which we meet with in Galen and Pliny; the latter writer speaks of Caryophyllon as resembling pepper but longer and more brittle and imported for the sake of its odour. We do not think it possible that a spice in such common use in the East can have escaped their notice. Paulus describes cloves as the flowers of a tree, and καρφιοειδη (like a nail). Myrepsicus in a prescription calls mother cloves γαρεόφαλον το μέγα το λεγόμενον παῤ 'Ιταλοις ἀνθοφαλον. In the debased Greek of the later Greek physicians, the name takes various forms more nearly corresponding to the Arabic. Later Arabian and Persian authors of treatises on Materia Medica describe cloves as the fruit of a tree growing in Java or Batavia, a territory belonging to the Dutch Christians. In the *Makhzan-el-Adwiya*, a work written about one hundred years ago, it is distinctly stated that they are only produced in the Dutch possessions, and that they are of two kinds, male and female. The fruit of the clove is called Narlaung (male clove) in India, a strange mistake but a common one among Asiatics, who argue that the seed-bearing organ or plant must be the male. Mahometan writers describe cloves as hot and dry, and consider them to be alexipharmic and cephalic, whether taken internally or applied externally; they also recommend them for strengthening the gums and perfuming the breath, and on account of their pectoral, cardiacal, tonic, and digestive qualities. They have a curious superstition to the effect that one male clove eaten daily will prevent conception. On the other hand, they tell us that the saliva after cloves have been chewed, if applied to the orifice of the male urethra before connection, increases the sexual orgasm in both parties. In modern medicine cloves are used as a

* Kirámbu, *Tamil;* Karámpu, *Malay;* Karámbu, *Cingalese.*

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carminative and stimulant; to relieve irritation of the throat accompanied by racking cough, and to deaden the pain of toothache.

Description.—The flowers of the Clove grow in cymes, when fit for gathering the calyx tube is of a bright red colour, and the tree presents a very beautiful appearance. The collection as witnessed by one of us at Zanzibar is by hand, each clove being picked singly. They are afterwards dried upon mats in the sun, which takes about three days. The dried clove is about two-thirds of an inch long, and consists of the calyx-tube, which divides above into four pointed spreading sepals, surmounted by a globular bud, consisting of 4 petals and enclosing a number of stamens. All parts of the clove abound in oil cells. If of good quality it should be plump, of a rich brown colour, and the oil should exude upon pressure being made with the finger nail; the taste should be aromatic and very pungent.

Mother cloves, called in India *Narlaung* (male cloves), are ovate-oblong berries about an inch long, and contain two dark-brown oblong cotyledons which abound in starch; they have the odour of cloves, but contain much less essential oil.

Clove stalks, in Guzerathi *Vikunia*, are only brought to India for re-export to Europe.

The *oil of cloves* of the Indian bazars is made by steeping cloves in sweet oil. No essential oil is manufactured in the country.

Chemical composition.—Oleum Caryophylli, which is the most important constituent of cloves, is obtainable to the extent of 16 to 20 per cent. But to extract the whole, the distillation must be long continued, the water being returned to the same material.

The oil is a colourless or yellowish liquid with a powerful odour and taste of cloves; sp. gr. 1·046 to 1·058. It is a mixture of a terpene and an oxygenated oil called *Eugenol*, in variable

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proportions. According to Schimmel & Co., the genuine oil of cloves has a specific gravity of 1·067, and the oil of clove stalks a specific gravity of 1·060 to 1·063. The former, which is termed *light oil of cloves,* and comes over in the first period of the distillation, has the composition $C^{15}H^{24}$, a specific gravity of 0·918, and boils at 254° C. Vapour density 7·7. It deviates the plane of polarization slightly to the left, and is not coloured on the addition of ferric chloride; it is converted by Br into $C^{15}H^{22}$ (250°—260°). (*Beckett and Wright Journ. Chem. Soc.* 29, 1.) Eugenol has a specific gravity of about 1·080 at 0° C., and possesses the taste and odour of cloves. Its boiling point is 252° (*Church*), vapour density 6·4. Eugenol, $C^{10}H^{12}O^{2}$, is devoid of rotatory power, it belongs to the phenol class, and has been met with in the oils of pimento, bay, canella, cinnamon, &c. According to G. Laube and H. Aldendorff, the percentage composition of cloves is water 16·39, nitrogenous matter 5·99, volatile oil 16·98, fat 6·20, sugar 1·32, nitrogen free extractive 37·72, cellulose 10·56, ash 4·84. The dried spice yielded nitrogen 1·15, volatile oil and fat 27·72. A principle called *caryophyllin,* which occurs in silky needles in stellate groups, has been isolated from cloves; by the action of nitric acid it is converted into caryophyllic acid. (*Watts, Dict. Chem., 2nd Ed.*)

Commerce.—The imports of cloves into India in 1884-85 were 4,791,006 lbs., valued at Rs. 11,09,841, all from the east coast of Africa and Zanzibar. Of this quantity 4,598,419 lbs. came to Bombay. During the same year Bombay re-exported 1,618,465 lbs., of which 1,112,224 lbs. went to the United Kingdom, and 473,799 lbs. to China and the Straits.

MELALEUCA LEUCADENDRON, *Linn.*

Fig.—*Bentl. and Trim., t.* 108.

Hab.—Indian Archipelago, Malay Peninsula. The essential oil.

Vernacular.—Kayaputi-ka-tel (*Hind.*), Kaiyappudai-tailam (*Tam.*), Kayaputi-tail (*Beng.*), Kayputi-nu-tel (*Guz.*), Kayaputi-che-tel (*Mar.*).

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History, Uses, &c.—This oil appears to have been first prepared as an article of commerce by the Dutch about 1727. Rumphius, who passed nearly fifty years in the Dutch East Indies, and died at Amboyna in 1702, was the first to bring to notice that the Malays and Javanese made use of the leaves on account of their aromatic properties; this led to their distillation, and Rumphius relates how the oil was obtained in very small quantities, and was regarded as a powerful sudorific. It was probably unknown in India before the commencement of the present century, about the time when it first became an article of commerce in England. The island of Bouro in the Molucca Sea is stated by Bickmore, an American traveller, who passed some time there, to produce about 8,000 bottles annually; but from the trade returns of the Straits Settlements it appears that the largest quantity is shipped from Celebes. (*Pharmacographia.*) The oil is much used in India as an external application for rheumatism, and has also been given internally in chronic cases with advantage. It is a powerful stimulant and antispasmodic in choleraic diarrhœa, and on account of its stimulant and rubefacient action it is a useful local application in the chronic forms of pityriasis, psoriasis, eczema and acne so common in India.

Description.—Cajuput oil varies in colour from yellowish green to bluish green; it is a transparent mobile fluid, with an agreeable camphoraceous odour, and bitter aromatic taste, sp. gr. 0·926, it remains liquid at 13° C., and deviates the ray of polarized light to the left.

Chemical composition.—The researches of Schmidt and other chemists have shown that cajuput oil consists chiefly of hydrate of cajuputal or cineol, $C^{10}H^{18}O$, which may be obtained from the crude oil by fractional distillation at 174° C. If it is repeatedly distilled from P^2O^5 it is converted into terpenes. Cineol, a liquid smelling like camphor, is the chief constituent of Ol. Cinæ and Ol. Cajuputi; it occurs also in oil of Rosemary. (*Weber.*) For its reactions and chemical composition the reader is referred to Watt's Dict. of Chem. by Morley and

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Muir (ii. 187). R. Voiry (*Chem. News*, June 15th 1888, p. 241,) states that on fractional distillation cajuput oil yields a terpilenol, which has no action on polarized light. He further obtained acetic, butyric and valerianic ethers mixed with a carbide boiling at 160° in a vacuum.

The green tint of the oil is due to copper, a minute proportion of which metal is usually present in all that is imported. It may be made evident by agitating the oil with very dilute hydrochloric acid. To the acid, after it has been put into a platinum capsule, a little zinc should be added, when the copper will be immediately deposited on the platinum. The liquid may be then poured off, and the copper dissolved and tested. When the oil is rectified, it is obtained colourless, but it readily becomes green if in contact for a short time with metallic copper.

Commerce.—The oil is imported into India from Singapore in large quantities packed in common black quart bottles. From the official trade reports of the latter port it appears that India is the chief market for this article. Average value, Re. 1½ per bottle.

EUGENIA JAMBOLANA, *Lam.*

Fig.—*Wight Ic., t.* 535 ; *Bedd. Fl. Sylv. i., t.* 197.

Hab.—India. The fruit, leaves, seeds and bark.

Vernacular.—Jámun (*Hind.*), Kálájám (*Beng.*), Jámbú (*Mar.*), Navel (*Tam.*), Jambúdo (*Guz.*), Neredi (*Tel.*), Nevale (*Can.*).

History, Uses, &c.—This tree, which yields an abundant crop of subacid edible fruit, during the hot weather, is common all over the country. In some places the fruit attains the size of a pigeon's egg, and is of superior quality. In Guzerat this large kind is called *Páras-jambudo.* The Jambu has numerous synonyms in Sanskrit, it is called *Meghavarna* (cloud-coloured), *Meghabha* (cloud-like), *Nilaphala* (black-fruited), *Raja-*

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phala (king's-fruit), &c. According to the Dirghama-Sutra it is one of the four colossal mythic trees which mark the four cardinal points, standing to the south of Mount Méru; four great rivers rise at its foot. The Vishnupurana states that the continent of Jambudvipa takes its name from this tree. Ibn Batuta, who visited India in 1332, mentions جمون (*Jamún*) as one of the fruits of Delhi. A vinegar prepared from the juice of the ripe fruit is an agreeable stomachic and carminative; it is also used as a diuretic. A sort of spirituous liquor, called Jámbáva, is described in recent Sanskrit works as prepared by distillation from the juice. The bark is astringent, and is used, alone or in combination with other medicines of its class, in the preparation of astringent decoctions, gargles and washes. The fresh juice of the bark is given with goat's milk in the diarrhœa of children. (*Chakradatta.*) The expressed juice of the leaves s used alone or in combination with other astringents in dysentery, as for example in the following prescription:—Take of the fresh juice of the leaves of *E. Jambolana* and the Mango about a drachm each, Emblic myrobalans a drachm, and administer with goat's milk and honey. (*Bhavaprakasa.*)

The author of the Makhzan notices the Jamún at considerable length; after describing the tree, he says that the fruit is a useful astringent in bilious diarrhœa, and makes a good gargle for sore throat or lotion for ringworm of the head. The root and seeds, he observes, are useful astringents, also the leaves. He tells us that a kind of wine is made from the fruit, and that the juice of the leaves dissolves iron filings, or, as he expresses it, reduces them to so light a condition that they float upon the surface of the liquid as a scum. This when collected and washed he recommends as a tonic and astringent. A wine and syrup of the fruit has been shown to us by Mr. M. C. Pereira of Bombay; they much resemble in flavour similar preparations made with red currants, and appear to have stomachic and astringent properties. Some years ago at Monghyr, in Bengal, excellent brandy was prepared from the fermented fruit. Of late years the seeds of this tree have been recommended as a remedy in diabetes.

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Dr. C. Graeser, of Bonn, has published in the *Centralblatt für Klinische Medicin* a highly-interesting account of a series of experiments with the extract of the fruit of *Syzygium Jambolanum* on dogs, which had previously been made diabetic by the administration of phloridzin.

Dr. Graeser thought that the best way of studying the physiological and therapeutic action of the new drug was to administer it to dogs which had artificially been made diabetic by a method introduced by V. Mehring, who found that artificial diabetes can at any moment be produced in dogs by the administration of phloridzin.

A young dog of 2,700 to 4,800 grammes body weight, to which 2·5 to 4·8 grammes of phloridzin (1 gramme to 1 kilo body weight) have been given, in the course of a day will show an excretion of sugar, lasting for twenty-four to thirty hours, and amounting to 5·89 to 12·45 grammes. Graeser first gave the daily dose of phloridzin, but later on he split the quantity into doses of 1 gramme, given every two to three hours. In both cases the excretion of sugar was the same. Diarrhœa was caused by phloridzin in three cases. After Graeser had experimented for some time with phloridzin alone he began to administer simultaneously phloridzin and extract of *Syzygium Jambolanum*. The latter was given before, along with, or after phloridzin, and invariably had the effect of reducing the expected excretion of sugar most considerably. This reduction amounted to at least half, in some cases even to nine-tenths, of the quantity of sugar which would have resulted had phloridzin alone been given. At the same time the duration of the diabetes was shortened. Dogs, which under phloridzin alone had excreted 5·89 to 12·45 grammes of sugar, showed under the jambul treatment a maximum excretion of 2·906 grammes of sugar, and a minimum excretion of 1·5 gramme.

As jambul showed such a powerful effect on the artificially-produced diabetes, it may be anticipated that when given at the proper time and in a large dose it will entirely prevent the excretion of sugar.

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It is not yet known how jambul given in large doses acts on the pathological diabetes mellitus of man. But it is well worth trying. The experiments on man are all the more justified as no ill effect has ever yet been produced by the new drug. A favourable effect of such experiments would prove that phloridzin diabetes and pathological diabetes are of a similar nature.

In all the animals on which Graeser experimented no signs of any secondary effects of jambul extract were observed, not even after doses of 18 grammes. In one case diarrhœa set in, which, as further experiments proved, was caused by phloridzin and not by jambul.

All his experiments were made with extract of jambul prepared by Mr. R. H. Davies, F.I.C., chemist to the Society of Apothecaries, London, from seeds which the author had himself brought over to Europe. As the fruit contains great quantities of starch, it was thought advisable to eliminate this as much as possible in preparing the extract. Several extracts were prepared out of the whole fruit, or solely out of the kernel or solely out of the pericarp ; 100 grammes of the fruit gave 16⅓ grammes kernel-extract, and 11⅗ grammes pericarp extract. The most given in one single dose was 6 grammes, the maximum daily dose 18 grammes.

Whether the active principle is contained in the pericarp or kernel cannot as yet be decided to a certainty. Probably it is contained in both, but to a greater extent in the pericarp.

From the long series of experiments which he has made, Graeser draws the following conclusions :—

1. Phloridzin diabetes is considerably lessened by jambul extract.

2. Jambul extract is non-poisonous, and does not cause any ill effect.

3. The active principle contained in jambul is not yet known. It will have to be determined by careful analysis and further experiments. (*Chem. and Druggist* 1889.)

With reference to Graeser's experiments, G. I. Iaveïne (*Vratch.*, 1889, p. 1029,) records having obtained negative re-

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sults with the seeds in three cases of diabetes in which the urine contained from 6 to 7 per cent. of sugar. In these cases the powdered seeds were given in doses of one gram 4 to 6 times a day.

Description.—The fruit unless improved by cultivation is about the size and shape of a small olive, of a purple colour, and very astringent; within it is a thin white papery shell, which encloses a large green kernel, also very astringent. The bark is grey and fissured externally; internally it is red and fibrous; its minute structure is remarkable in having several rows of very large, pitted, oblong-oval cells, which can be easily seen with the naked eye. The odour is like that of oak-bark, and the taste very astringent. The leaves are 3 to 6 inches long, ovate or oblong, obtuse, more or less acuminate, coriaceous, smooth, shining, closely nerved, the numerous nerves uniting within the margin. When crushed they have an agreeable terebinthinate odour, and on distillation yield a bright green oil.

Chemical composition.—The proximate composition of dry Jambul seeds according to Elborne is—

Essential oil	a trace
Chlorophyll and fat	0·37
Resin soluble in alcohol and ether	0·30
Gallic acid	1·65
Albumin	1·25
Coloured extractive soluble in water	2·70
Moisture	10·00
Insoluble residue	83 73
	100·00

Jambulin, a glucoside, is stated to have been found in the seeds; it is said to have the power of preventing the diastatic conversion of starch, &c., into sugar. The bark of the tree contains 12 per cent. of tannin and affords a Kino-like gum.

Commerce.—The fruit and seeds are sold in the Indian markets.

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PSIDIUM GUYAVA, *Linn.*

Fig.—*Rheede Hort. Mal.* iii., *t.* 34, 35; *Rumph. Amb.* i., *t.* 47. Guava tree (*Eng.*), Goyavier (*Fr.*).

Hab.—America, naturalized in India. The bark and leaves.

Vernacular.—Lál-safri-ám, Sufed-safri-ám (*Hind.*), Lál-jám, Sufed-jám (*Duk.*), Támbara peru, Pándhara peru (*Mar.*), Shivappu-goyyá-pazham, Vellai-goyyá-pazham (*Tam.*), Tella-jám-pandu, Erra-jám-pandu (*Tel.*), Bili-shibe-hannu, Kempu-shibé-hannu (*Can.*), Dhop-goachhi-phal, Lal-goachhi-phal (*Beng.*).

History, Uses, &c.—The red and white guavas appear to be only varieties of one and the same species. They have been introduced into India from America, probably by the Portuguese, and are now universally cultivated, and in some parts of the country have run wild. The fruit is a favourite with the natives, who like its strong aromatic flavour. It is astringent and has a tendency to cause costiveness. Europeans generally prefer it cooked, or in the form of jelly. In Goa the Portuguese make a kind of cheese of it. The bark, which is also astringent, is recommended in the *Pharmacopœia of India* as a remedy for the chronic diarrhœa of children. Dr. Waitz (*Diseases of Children in Hot Climates*, p. 225,) directs half an ounce of the root bark with six ounces of water to be boiled down to 3 ounces; of this decoction, the dose is one or more teaspoonfuls three or four times a day. He also recommends the same preparation as an external astringent in the prolapsus ani of children (p. 233). The leaves have also been used successfully as an astringent in diarrhœa.

Discourtilz places this plant among the aromatic antispasmodics; a decoction of the young leaves and shoots is prescribed in the West Indies in febrifuge and antispasmodic baths, an infusion of the leaves in cerebral affections, nephritis and cachexia; the pounded leaves are locally applied in rheumatism; an extract is used in epilepsy and chorea; the tincture is rubbed into the spine of children suffering from convulsions. The fruit and its

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conserve are astringent and suitable to those suffering from diarrhœa and dysentery. (*Corre et Lejanne, Résumé de la Mat. Med. Coloniale*, p. 108.)

Description.—The external surface of the bark when fresh is smooth and brown, marked by superficial scars indicating the separation of squamous plates of dead bark. These plates sometimes remain partially attached. Beneath the brown epidermis the fresh bark is green; its inner surface is marked by longitudinal striæ, and is of a light brown colour. The taste is astringent and agreeably acid. The leaves are aromatic, egg-shaped or oblong, short stalked, covered with soft down underneath, and with the principal veins very prominent.

Microscopic structure.—Sections show that the bark consists of an epidermis, made up of two rows of brick-shaped brown cells, and alternate zones of vascular and parenchymatous tissue, varied towards the inner part by three broken circles of liber cells. The medullary rays are numerous, and together with the parenchyma of the outer part of the bark, loaded with green colouring matter; in the rays this extends some distance into its substance, and makes them very conspicuous. The vascular system is loaded with crystals, and contains a few starch granules.

Chemical composition.—The watery extract of the bark contains, as the mean of two determinations, 27·4 per cent. of tannin. Spirit dissolves the same amount of extract from it as water, about 33 per cent. The tannin gives a blue-black colour with ferric salts, a pinkish precipitate with gelatine, and a dirty green with acetate of lead; the lead compound when perfectly dry yields 29 per cent. of oxide.

After exhausting the bark by means of water and alcohol, another colouring matter is removed by soda, probably oxidized tannin. Ether extracts chlorophyll, and a little resin soluble with a bright red colour in alkaline liquids. No alkaloids or ammonia are present. The mineral matter obtained by incineration is 10 per cent., and consists of calcium carbonate

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afforded by the calcium oxalate which is present in the bark in the form of simple crystals. The tannage or inspissated watery extract of guava bark is reddish brown and brittle, very soluble in water, and containing as it does tannin in a free state, should be a useful astringent.

MYRTUS COMMUNIS, *Linn.*

Fig.—*Duhamel ed. nov. t.* 43. Myrtle (*Eng.*), Myrte (*Fr.*)

Hab.—Europe. Cultivated in India. The leaves, fruit and bark.

Vernacular.—Aas (*Arab.*), Vilayati-mehndi (*Hind.*). The berries, Hab-el-aas (*Arab., Ind. bazars*).

History, Uses, &c.—Amongst the ancients the Myrtle (μυρσίνη) was a phallic emblem sacred to Venus, at the festival of Myrrha, the incestuous mother of Adonis, married women wore wreaths of the leaves; and in Virgil's infernal regions the victims of love concealed themselves among the myrtles. At Rome this plant was not allowed to be placed upon the altar of *Bona Dea,* but at the festivals of Eleusis every one was crowned with it; it was supposed not only to inspire love, but to maintain it. According to a Greek myth, the nymph Myrsine, having outstripped Athene in a race, was turned into a myrtle bush by the goddess, who, however, repenting of her cruelty afterwards, became particularly attached to the plant. The Romans, after they had intended fighting for the Sabine women whom they had carried off, purified themselves with sprigs of myrtle, *ideo tunc lecta* (says Pliny) *quoneam conjuctioni et huic arbori præest Venus.* Pliny also tells us that Romulus planted two myrtles at Rome, one of which afterwards became the favourite of the patricians, and the other of the people; when the former had the upper hand the plebeian myrtle withered, but when the power of the latter was in the ascendant the patrician myrtle faded. Before pepper was known myrtle berries were employed as a spice to season food, and wine was flavoured with them. (*Hist. Nat.* 15, 35.) For many other

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superstitions concerning the myrtle extending down to modern times, see De Gubernatis (*Myth. des Plantes, II.*, 233).

The myrtle occupies a prominent place in the writings of Hippocrates, Pliny, Dioscorides, Galen, and the Arabian writers. Pliny furnishes an account of it, of which the following is a summary: The berries arrest hæmoptöe; they are used in dysentery and as an application to indolent ulcers and inflamed eyes; and in wine are an antidote to the poison of mushrooms; they also cure the bites of scorpions, inflammation of the bladder, headaches, abscesses, aphthæ, leucorrhœa, and other mucous discharges. The juice is diuretic, but constipates. An ointment made with it cures eruptions of the skin and darkens the hair. The dried leaves in powder arrest sweats; in fomentations check the white flux, correct prolapsus of the womb and rectum, and are employed to cure ulcers, burns, erysipelas, otorrhœa, alopecia, and eruptions of the skin, to arrest hæmorrhage, and as an application to lentigo, pterygion, panaris, condylomata, and swelled testicles. A wine made from the berries was used for most of these purposes, and was regarded as tonic. This catalogue of virtues is repeated, but hardly enlarged, by subsequent ancient writers, who, however, following Galen, ascribe to myrtle the opposite qualities of cold and hot, or astringent and stimulant, the former residing chiefly in the leaves, the latter in the berries.

In 1876 attention was directed to the medicinal properties of the plant by Delioux de Savignac, who recommended an infusion or diluted tincture of the leaves as an astringent lotion, and the finely powdered leaves as an application to ulcers, &c. He also used the powder in doses of 1 to 4 grams internally in chronic catarrh of the bladder and in menorrhagia; and the infusion in chronic bronchitis. The *Oxymyrsine* or "wild myrtle," mentioned by the ancients, the *Aas-el-bari* of Mahometan writers, is not a myrtle, but the *Ruscus aculeatus* or "butcher's broom."

Of late years the volatile oil of myrtle leaves has been brought to notice as an antiseptic and rubefacient when used externally; given internally, in small doses (0·06 to 0·09 gram), it

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promotes digestion like myrtle berries, but in large doses it acts as an irritant. It is excreted by the kidneys and through the respiratory tracts, and communicates a peculiar odour to the urine. According to Lauder Brunton the urine of persons taking it gives a precipitate with nitric acid; he considers that like copaiba it may be used as an expectorant in chronic bronchitis with profuse expectoration and in chronic inflammation of the bladder or urethra. It is best administered in gelatine capsules containing 4 to 5 drops of the oil. The fragrant water distilled from the flowers and leaves is known in France as *Eau d' ange.* According to Brannt, the manufacturers of volatile oils in Southern France place a myrtle water upon the market which is actually prepared from the oil.

Chemical composition.—Riegel (1849) obtained from the ripe berries a volatile oil, resin, tannin, citric acid, malic acid, sugar, etc. Raybaud (1834) found the volatile oil, as distilled from the leaves, flowers, and fruit, to have a yellowish or greenish-yellow colour, and to be lighter than water. Gladstone (1863) ascertained it to have a specific gravity of ·891, to be dextrogyre, and to consist mostly of a hydrocarbon, $C^{10}H^{16}$, boiling between 160° and 170° C. E Jahns (1889) examined a sample of Spanish origin, having a sp. gr. of ·910 at 16°, and a rotatory power of $[a] = +26{\cdot}7°$. On fractional distillation the terpene, $C^{10}H^{16}$, came over at 158° – 160°; rotatory power $[a]_D = +36{\cdot}8°$, and corresponded in its chemical properties with dextropinene. Cineol, boiling at 170°, a second constituent, was obtained by Wallach's process. A little camphor was also present but could not be isolated. (*Journ. Chem. Soc.*, June, 1889.) The bitter principle has not been investigated; it is probably a glucoside.

Commerce.—Dried myrtle berries are obtainable in most of the Indian bazars.

MELASTOMACEÆ.

MEMECYLON EDULE, *Roxb.*

Fig.—*Roxb. Cor. Pl. I., t.* 82; *Wight Ic., t.* 278. Iron-wood tree (*Eng.*), Mémecylon comestible (*Fr.*).

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Hab.—Eastern and Western Peninsulas, Ceylon.

Vernacular.—Anjana, Yálki, Kurpa, Lokhandi (*Mar.*), Kashamaram (*Tam.*), Alli-cheddu (*Tel.*), Surpa (*Can.*), Warikaha, Seroo-kaya (*Cingh.*).

History, Uses, &c.—*M. edule,* also called *M. tinctorium* from its use in dyeing, is a shrub or small tree growing on hilly ground. In Sanskrit it is called Anjani, a name derived from *anjana,* a pigment or collyrium. The leaves are used in India and Ceylon as a dye, and afford an evanescent yellow lake when used alone. They are chiefly valued on account of their action as a mordant, and are used with myrobalans and Sappan wood or Chayroot (*Oldenlandia umbellata*) in preference to alum in producing a deep red colour much used by matmakers in Madras. Medicinally, an infusion of the leaves is used as an astringent collyrium in conjunctivitis, and a decoction of the root in menorrhagia. The pounded bark with aromatics, such as ajwan, pepper, and zedoary is tied up in a cloth for fomentation or applied as a plaster (*lep*) to bruises. Dr. Peters has brought to our notice the use of the leaves in the Deccan as a remedy for gonorrhœa of considerable repute. Sprengel, apparently misled by the Cinghalese name Warikaha, supposed the leaves to be source of the Wars dye of the Arabians.

Description.—The *Flora of British India* notices twelve varieties of this extremely variable plant, which is generally a large bush, remarkable for its bright green foliage, and clusters of purplish-blue flowers on the bare branches, which are succeeded by globose deep purple berries about ¼ inch in diameter, and crowned with the 4-toothed limb of the calyx. The berries are edible but astringent. The leaves are from 1½ to 3½ inches in length, and 1 to 1¼ inch broad, entire, firm, and leathery, with short petioles, and very indistinct lateral venation, they turn yellowish-green when dry; the taste is acid, bitter and astringent.

Chemical composition.—Prof. Dragendorff (*Pharm. Zeitchr. für Russland,* xxi., 232,) proved the absence of an alkaloid,

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and the presence of a yellow glucoside in the leaves. The latter he considered not to bear any resemblance to chrysophanic acid.

A proximate analysis of the leaves, which we have made, indicated the following constituents:—

Moisture	6·90
Chlorophyll and resins	5·59
Resins, malic acid and glucose; spirit extract	16·00
Colouring matter, gum, malates and glucose; water extract	17·94
Dissolved by soda solution	4·42
Starch and pararabin removed by boiling dilute HCl	23·32
Crude fibre and silica	25·83
	100·00

The total malic acid amounted to 6·48 per cent., glucose 6·25, and the total inorganic matter 11·80 per cent. The alcoholic extract was brown in colour, sweet and styptic to the taste, and nearly all soluble in water; the solution readily reduced Fehling's solution, and gave a crystalline precipitate with lead acetate. The aqueous solution was yellow-coloured; it afforded a precipitate of mucilage and salts with two volumes of alcohol, and gave a crystalline precipitate with lead acetate. A decoction of the leaves afforded a green colour with iodine solution through the blending of the natural colour with the starch iodide. The colouring matter is freely soluble in water, sparingly in spirit, and insoluble in ether. The aqueous solution is turned greenish-brown by ferric chloride and is not affected by gelatine, the colour is not precipitated by neutral plumbic acetate or by acids; it is intensified by the fixed and volatile alkalies. The glucosidal decomposition is preferably effected by boiling with dilute hydrochloric acid, which results in the deposition of a red powder attended with the formation of a volatile substance having the odour of saffron. The red decomposition product is very sparingly soluble in water, insoluble in ether, and very soluble in rectified spirit and dilute alkaline liquors; a spirit solution is precipitated by ether. It

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affords an intense yellow colour with diluted alkali, and orange brown when concentrated, and is precipitated in brown flocks by acids. Sulphuric acid forms with it a yellowish-brown solution, from which it separates on standing in a pulverulent condition; nitric acid dissolves it with the formation of a fine red hue. The decomposition product is resinoid and amorphous, and is neutral in reaction.

LYTHRACEÆ.

AMMANNIA BACCIFERA, *Linn.*

Fig.—*Lam. Ill., t.* 77, *f.* 5.

Hab.—Tropical India. The herb.

Vernacular.—Dád-mári (*Hind.*), Guren, Bhár-jambúl (*Mar.*), Kallurivi, Nirumel-neruppu (*Tam.*), Agni-venda-páku (*Tel.*), Kallur-vanchi (*Mal.*)

History, Uses, &c.—Ammannia is supposed by some to be the Agni-garbha, "or plant pregnant with fire" of Sanskrit writers, but this is very doubtful, as the same name is applied to the Arani or soft wood used in the production of the sacrificial fire. The properties of this plant and its use by the natives as a blistering agent appear to have been first brought to the notice of Europeans by Roxburgh. Ainslie quotes him, and remarks that the plant has a strong muriatic smell, but not disagreeable; the leaves are extremely acrid, and are used by the natives to raise blisters in rheumatism, fevers, &c., the fresh leaves bruised and applied to the part intended to be blistered, perform their office in half an hour, and most effectually. In Pudukota, under the name of *Sigappuppugai*, the plant is used to prepare a liniment which is applied to the temples as a remedy for burning pain in the eyes. The author of the *Bengal Dispensatory* states that he made a trial of the leaves in eight instances; "blisters were not produced in less than twelve hours in any, and in three individuals not for 24 hours. The bruised leaves had been

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removed from all after half an hour. The pain occasioned was absolutely agonizing until the blister rose; they caused more pain than cantharides, and were far inferior to the *Plumbago rosea* in celerity and certainty of action." According to Fleming, the leaves are applied to cure herpetic eruptions. The authors of the *Pharmacopœia of India* merely notice the unfavourable opinion of the drug expressed in the *Bengal Dispensatory*. We have made some experiments with an ethereal tincture of the leaves, which lead us to form a much more favourable opinion of them; in several instances it blistered rapidly, effectually, and without causing more pain than the liquor epispasticus of the *Pharmacopœia*, which it resembles in colour. Upon evaporation of the ether a dark green resinous extract is left. A spirituous tincture was also tried, but it was not nearly so efficient. Dr. Bholanath Bhose describes a mode of treatment of obstinate spleen disease by the juice of the leaves administered internally, but its administration in this manner has been objected to as causing pain and yielding uncertain results. In the Concan the juice is given with water to animals when in heat to extinguish sexual appetite; the plant fresh or dried is administered in decoction with ginger and Cyperus root for intermittent fevers, and its ashes are mixed with oil and applied to herpetic eruptions. Ammannia is common in low moist ground in India, and flowers in November and December.

Description.—An herbaceous, erect, much-branched plant, having foliage something like that of rosemary; stems 4-sided; leaves sessile, opposite, lanceolate, attenuated, about an inch long and ⅛ inch broad, much smaller on the upper parts of the plant; calyx 4-cleft to the middle; lobes acute; accessory teeth very small; flowers very minute, aggregated in the axils of the leaves, almost sessile; tube of the calyx at first narrow and tightened round the ovary, in fruit cup-shaped; petals wanting; capsule longer than the calyx, 1-celled; flowers red. The whole plant has an aromatic and rather agreeable odour.

Chemical composition.—An alcoholic extract prepared with 80 per cent. alcohol was made from the air-dried and powdered

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plant: the greater part of the alcohol distilled off, and the remainder allowed to evaporate by exposure to air. When free from alcohol the extract was boiled with water, and the liquid separated from insoluble matter while hot. The filtrate was at first of a dark reddish brown colour, but became turbid on cooling, a dark resin separating on the sides of the capsule: no crystalline matter separated. After standing for some days the fluid was separated from suspended matter, and agitated with ether. The ether extract was of a yellow colour, indistinctly crystalline, possessed a very aromatic odour, and had a strongly acid reaction. An aqueous solution gave a deep brownish, almost black precipitate with ferric salts: with ammonia a deep caramel yellow colour, which darkened somewhat on exposure. With alkaloidal reagents negative results were obtained; after boiling with dilute sulphuric acid, the solution slightly reduced Fehling's solution, indicating the probable presence of a glucoside. Some of the aqueous solution rubbed on the skin of the arm produced no vesication. The dark resin which separated on the sides of the capsule on boiling the alcoholic extract with water, dried to a brittle black mass, but with a purple tinge, in thin layers. This substance was easily soluble in alkalies, and was reprecipitated by acids in cinnamon coloured flocks. With cold nitric acid it dissolved at once, forming a deep reddish liquid, which after standing for a short time evolved nitrous fumes. In acetic acid it was also soluble, but less readily than in nitric acid. In ether it was insoluble. An alcoholic solution gave with ferric chloride a black precipitate, which was changed to dark brown on the addition of acids. Applied to the skin in alcoholic solution negative results were obtained. That portion of the alcoholic extract originally insoluble in water consisted of resinous matter. Some of the powdered plant was distilled with water, the distillate had a slight odour, but yielded practically no extractive when agitated with ether. In one experiment the distillate afforded a very faint red coloration with ammonia, but on repeating the experiment negative results were obtained. An alcoholic tincture of the plant applied to the skin of the arm produced no vesication, and a similar negative

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result was also obtained with an ethereal solution, and though there is very little doubt that plumbagin is the active principle of the drug, only in one experiment was any reaction similar to that yielded by plumbagin obtained. It is probable that the sample operated on was inactive from the failure to obtain any vesication with an ethereal solution of the whole plant, more especially as a subsequent distillation of seven pounds of the dried and powdered drug from another source yielded a distillate having the strong aromatic odour of plumbagin, and which when shaken with ether afforded a yellow crystalline substance which, on re-solution, gave a red colour with alkalies.

WOODFORDIA FLORIBUNDA, *Salisb.*

Fig.—*Roxb. Cor. Pl., t.* 31; *Bot. Mag., t.* 1906. Downy Grislea (*Eng.*), Grisléa multiflore (*Fr.*).

Hab.—Throughout India. The flowers.

Vernacular.—Dhái, Dávi, Devti (*Hind.*), Dhaití, Dhaoshi, Phulsatti (*Mar.*), Dhaiphul (*Beng.*), Serinjí (*Tel.*), Dhátaki (*Can.*).

History, Uses, &c.—The Sanskrit names of this shrub well describe its prominent characters. It is called Agni-jvála (fire-flame), Tamra-pushpi (red-flowered), Guchchha-pushpi (cluster-flower), Párvatí (hill-born). The usual name is Dhátaki. It is mentioned by Chakradatta and Sarangadhara on account of its astringent properties. As a medicine the flowers are chiefly prescribed by the natives in dysentery, beaten up with honey into a kind of confection. They are also thought to be of use in menorrhagia; externally they may be used as an astringent. The natives of the Concan in bilious sickness fill the patient's mouth with sesamum oil, and apply the juice of the leaves to the crown of the head; this is said to cause the oil in the mouth to become yellow from absorption of bile; fresh oil is then given repeatedly until it ceases to turn yellow. Commercially the flowers are of considerable importance as a dyeing and tanning material.

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Description.—The flowers and their calices are red, the latter are permanent, and retain their colour after the flower has faded. As met with in commerce the calices generally contain the nearly mature capsules, which are two-celled and two-valved and completely enclosed. The seeds are light brown, very minute, oblong and very numerous; if the calyx is soaked in water it will be seen to be 12-toothed. In ordinary samples of the article some of the flowers are in small racemes, and a good many lanceolate leaves with a whitish under surface studded with black dots are mixed with them; both sides of the leaf will, if examined with a lens, be seen to be covered by a close dense tomentum. The enlarged calices are very astringent.

Chemical composition.—The flowers yielded to Hummel 20·6 per cent. of tannic acid, which explains their use by the Hindus in connection with alum as a mordant and with other dye-stuffs. (*Watt, Select. from the Records of the Govt. of India, Vol. I., pp.* 91 *and* 93.)

Commerce.—The article is collected in large quantities. Value, Rs. 15—25 per kandy of 5¼ cwts. The variation in price depends upon the quantity in the market.

LAWSONIA ALBA, *Lam.*

Fig.—*Lam. Ill., t.* 296, *f.* 2; *Wight Ill., t.* 87; *Griff. Ic. Pl. Asiat. t.* 580. Henna (*Eng.*), Henné (*Fr.*).

Hab.—Western India; cultivated throughout India. The leaves and flowers.

Vernacular.—Méhndí (*Hind.*), Mendi (*Mar., Guz.*), Marutonri, Aivanam (*Tam.*), Méhédi (*Beng.*), Goranta (*Tel.*), Gorante (*Can.*).

History, Uses, &c.—Henna is the Mendika and Raktagarbha, or "plant pregnant with red colouring matter," of Sanskrit writers. It is much esteemed by the Mahometans. There is a tradition that their Prophet spoke of it as "*Syyadu*

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riáhín" (the best of herbs). In Arabic it is called Hinna. Arabic and Persian works give Arkán and Fákúliyún as the Greek names;* they describe the leaves as a valuable external application in headache, combined with oil so as to form a paste, to which resin is sometimes added. They are applied to the soles of the feet in small-pox, and are supposed to prevent the eyes being affected by the disease. They also have the reputation of promoting the healthy growth of the hair and nails. An ointment made from the leaves is spoken of as having valuable healing properties, and a decoction is used as an astringent gargle. The bark is given in jaundice and enlargement of the spleen, also in calculous affections, and as an alterative in leprosy and obstinate skin diseases, in decoction it is applied to burns, scalds, &c. The seeds, with honey and tragacanth, are described as cephalic. An infusion of the flowers is said to cure headache, and to be a good application to bruises; a pillow stuffed with them has the reputation of acting as a soporific. (*Dr. Emerson.*) An ointment is also applied to bruises, and a perfumed oil is prepared from them, which is called in Arabic Duhn-el-fúghiya and is used as a cosmetic.

Ainslie notices the use of an extract prepared from the flowers and leaves by the Tamil physicians of Southern India as a remedy in lepra, half a teaspoonful twice a day being the dose. He also says that the leaves are applied externally in cutaneous affections. In the Concan the leaf-juice mixed with water and sugar is given as a remedy for spermatorrhœa, and with milk in the condition popularly known as "hot and cold fits."

In the *Pharmacopœia of India* attention is drawn to their use in an obscure affection called "burning of the feet," often met with in India; and the editor mentions his having himself witnessed, when in Burmah, a great amount of tempo-

* The κυπρος of Dioscorides (i., 109,) and Cyprus of Pliny (13, 51; 23, 46) appear to be Henna, as 'the leaves dye the hair of an orange colour.' Arkan ارقان is an Arabic word meaning a blight or disease which turns plants or men yellow (jaundice).

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rary relief from the remedy when numerous other means had previously failed. The fresh leaves beaten up into a paste with vinegar were applied as a poultice to the soles of the feet in most cases, but some patients obtained greater relief from using strong frictions with the bruised leaves over the part. In Southern India Henna seeds are called *Iswan,* a corruption of the Persian word Isband or Ispand, a name applied to the seeds of *Peganum Harmala* by the Persians. They are used by the Mahometans of those parts as a substitute for the true Ispand in certain superstitious observances. (*See Peganum.*)

The use of Henna for dyeing the hands and feet appears to be common among Mahometans in Asia and Africa, and was probably practised by the ancient Egyptians and Jews. Sir G. Birdwood has the following remarks upon its history in more Western countries:—"Solomon is supposed by Sprengel to refer to the Henna plant in his Epithalamium (I. 14), 'My beloved is unto me as a cluster of Samphire (or Cypress or Camphire) in the vineyards of Engedi.'" It is undoubtedly the κυπρος of Dioscorides and "Cyprus in Egypt" of Pliny. It is mentioned by Avicenna also under the name of "Henna."*

Description.—Leaves opposite, smooth, short petioled, oblong, or broad lanceolate, pointed at both ends, an inch or more long and less than half an inch broad; the flowers are in terminal, globular, cross-armed panicles, small, greenish white and very fragrant; the fruit is round, the size of a pepper-corn, four-grooved, with the apex depressed, four-celled; the seeds are angular. The decoction of the leaves is of a deep orange colour, which is destroyed by acids, and deepened by alkalies and vegetable astringents; it stains the skin of an orange red colour, which does not disappear until the epidermis has been renewed.

Chemical composition.—The colouring matter of Henna is a kind of tannin to which M. Abd-el-Aziz Herraory has given the name of *hennotannic acid.* This principle is brown, of a

* Cf. P. Bellonius Obs. II. 64. He visited Egypt in A. D. 1547.

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resinoid appearance, and soluble in boiling water. It possesses the properties of tannin, such as blackening ferric salts and precipitating gelatine. It reduces oxide of copper in Trommer's test, and heat decomposes it, with the production of crystalline needles, which reduce nitrate of silver. (*Jour. de Pharmacie, Jan.* 1863.) According to C. J. S. Thompson the leaves yield to boiling water from 12 to 15 per cent. o the brown colouring matter, which is soluble in glycerine, st. ong solutions of potash and ammonia, and dilute acids, but very slightly in ether, chloroform or alcohol: the leaves also yield 2 per cent. of an olive-green resin soluble in ether and alcohol.

PUNICA GRANATUM, *Linn.*

Fig.—*Bentl.* and *Trim.*, *t.* 113. Pomegranate (*Eng.*), Grenadier commun (*Fr.*).

Hab.—Socotra, Arabia, Africa (?). Cultivated throughout India. The fruit, rind, and root bark.

Vernacular.—Anár, Dárim (*Hind.*), Dálim (*Beng.*), Dálimba (*Mar.*), Dádam (*Guz.*), Mádalai (*Tam.*), Dánimma (*Tel.*), Dálimbe (*Can.*); the flowers, Julnár, Gulnár (*Arab.*, *Pers.*, *Hind.*), Pu-madalai (*Tam.*), Puvvu-dánimma (*Tel.*), Hushi-dálimbe (*Can.*).

History, Uses, &c.—The pomegranate, which by Dierbach's account is the Ῥοα Σίδη of Hippocrates, is in culture in the south of Europe, Arabia, Japan, Persia, and Barbary. It is also much cultivated in India, but the Indian fruit is greatly inferior to that which is imported from the Persian Gulf ports. The Sanskrit name is Dádima, and the fruit is called Shukadana (parrots' food) and Kuchaphala (breast fruit). Hindu physicians prescribe the juice of the ripe fruit combined with saffron as a cooling medicine. They also use the rind of the fruit and the flowers, combined with aromatics, such as cloves, cinnamon, coriander, pepper, &c., as an astringent in such bowel affections as are not accompanied with tenesmus. In the Concan the juice of the green fruit, rubbed with galls, cloves

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and ginger is given in honey as a remedy for piles. The juice of the flowers with Durva root juice (*Cynodon dactylon*) is used to stop bleeding from the nose. The root bark does not appear to be mentioned in any Sanskrit works on Materia Medica. The Arabs call the pomegranate Rummán; Anár is the Persian name. Mahometan writers describe three kinds, sweet, sour, and subacid. The Rummán-i-bari or Wild Pomegranate of these writers is, perhaps, the *P. protopunica* discovered by Balfour in Socotra, and which probably exists in the neighbouring continents of Africa and Arabia, but this name is also applied by the Arabs to the Tutsan or large Hypericum. Besides using the flowers and rind in a variety of ways on account of their astringency, they recommend the root bark as being the most astringent part of the plant, and a perfect specific in cases of tapeworm: it is given, in decoction, prepared with two ounces of fresh bark, boiled in a pint and a half of water till but three-quarters of a pint remain; of this when cold a wineglassful may be drunk every half hour, till the whole is taken. This dose sometimes sickens the stomach a little, but seldom fails to destroy the worm, which is soon after passed.*

The seeds of the pomegranate are considered to be stomachic, the pulp cardiacal and stomachic. It would appear that the Arabs derived their knowledge of the medicinal qualities of this plant from the ancients, as a similar account of them is found in Dioscorides and Pliny. The *balaustium* of these writers is the double pomegranate flower, a word which in the corrupted form of Balusitun is common in Arabic and Persian books.† The root bark and rind of the fruit are official in the *Pharmacopœia of India*. The official preparation of pomegranate root bark is open to objection on account of its nauseousness, and Mr. Siebold, in order to obviate this, has suggested a process for removing the astringent principles. (*Pharm. Journ.* [3], XIV., 396.) With a similar object Dr. Von Schroeder

* Compare with Dioscorides i., 131, περὶ ῥόας.

† Plin. 13, 34; 23, 57 to 61; Scribon. Comp. 85 and 112; Dios. i., 132; it is used to stop bleeding in accordance with the doctrine of signatures.

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has recommended the use of an extract free from tannic acid, but containing all the alkaloids of the bark. (*Pharm. Zeit.*, 1886, *Sept.* 18, p. 556.) The extract is prepared by treating a decoction of the bark with milk of lime to remove the tannic acid, filtering, neutralizing the filtrate exactly with sulphuric acid, evaporating it on a water bath almost to dryness, treating the residue with 70 per cent. alcohol, and then driving off the alcohol from the extract obtained, the product is described as nearly entirely crystalline and soluble in water with a slight turbidity. The yield is about one gram of extract from twenty grams of bark. In order to retard as much as possible the absorption of the pelletierine, which is present in the extract as a sulphate, it is recommended to add to this quantity one or two grains of tannic acid to convert the alkaloid into the difficultly soluble tannate.

It has been stated occasionally that the administration of pelletierine to adults has been followed by symptoms of poisoning, though not very serious ones, and this has caused hesitation in administering it to children. Some recently reported cases appear, however, to indicate that the physiological action of this tænifuge is relatively less energetic in infants than in adults. (*Archiv. der Pharm.*, *Sept.* 1886, p. 409.) Dr. Méplain administered six centigrams of pelletierine to a child two and a half years old, and Dr. Bétencès the same quantity to a child five years old without the least symptom of poisoning, but with the removal of the worm in both cases. In another case a dose of ten centigrams was successfully administered to a child ten years of age. (*Pharm. Journ.*, *Oct.* 2, 1886.)

Description.—The fruit of the pomegranate tree, in botanical language a *balausta*, is a spherical somewhat flattened and obscurely six-sided berry of the size of a common orange, and often much larger, crowned by the thick, tubular, 5 to 9-toothed calyx. It has a smooth, hard, coriaceous skin, which, when the fruit is ripe, is of a brownish yellow tint, often finely shaded with red. Membranous dissepiments, about 6 in number meeting in the axis of the fruit, divide the upper and larger portion into equal

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cells; below these, a confused conical diaphragm separates the lower and smaller half, which in its turn is divided into 4 or 5 irregular cells. Each cell is filled with a large number of grains, crowded on thick spongy placentæ, which in the upper cells are parietal but in the lower appear to be central. The grains, which are about $\frac{1}{2}$ an inch in length, are oblong or obconical and many-sided, and consist of a thin transparent vesicle, containing an acid, saccharine, red juicy pulp surrounding an elongated angular seed.

The peel as imported is in irregular, more or less concave fragments, some of which have the toothed, tubular calyx still enclosing the stamens and style. It is $\frac{1}{20}$ to $\frac{1}{10}$ of an inch thick, easily breaking with a short corky fracture; externally it is rather rough, of a yellowish brown or reddish colour. Internally it is more or less brown or yellow, and honeycombed with depressions left by the seeds. It has hardly any odour, but has a strongly astringent taste. The bark occurs in rather thin quills or fragments, 3 to 4 inches long. Their outer surface is yellowish grey, sometimes marked with fine longitudinal striations or reticulated wrinkles, but more often furrowed by bands of cork, running together in the thickest pieces into broad flat conchoidal scales. The inner surface, which is smooth or marked with fine striæ, and is of a greyish yellow, has often strips of the tough whitish wood attached to it. The bark breaks short and granular; it has a purely astringent taste, but scarcely any odour. (*Pharmacographia.*)

Microscopic structure.—The middle layer of the peel consists of large thin-walled and elongated, sometimes even branched, cells, among which occur thick-walled cells and fibro-vascular bundles. Both the outer and the inner surface are made up of smaller, nearly cubic and densely-packed cells. Small starch granules occur sparingly throughout the issue, as well as crystals of oxalate of calcium. In a transverse section of the bark, the liber is seen to be the prevailing part of the cortical tissue. The former consists of alternating layers of two kinds of cells, one of them loaded with tufted crystals of oxalate of calcium, the other filled with starch granules and astringent matter. The

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bark is traversed by narrow medullary rays, and very large sclerenchymatous cells are scattered through the liber. Touched with a dilute solution of a persalt of iron, the bark assumes a dark blackish blue tint.

Chemical composition.—"The bark contains, according to Wackenroder (1824), more than 22 per cent. of tannic acid, which Rembold (1867) has ascertained to consist for the most part of a peculiar variety called Punico-tannic Acid, $C^{20}H^{16}O^{15}$; when boiled with dilute sulphuric acid, it is resolved into Ellagic Acid, $C^{14}H^{8}O^{9}$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid, gallic acid, which appears sometimes to pre-exist in the bark. If a decoction of pomegranate bark is precipitated by acetate of lead, and the lead is separated from the filtered liquid, the latter on evaporation yields a considerable amount of mannite. This is probably the Punicin or Granatin of former observers." (*Pharmacographia, 2nd Ed., p.* 291.) Tanret (1878) announced the discovery of a liquid alkaloid which has the tænicide power of the bark. The alkaloid is obtained in a pure state by distilling its ethereal solution in a current of hydrogen, and maintaining the residue at a temperature of 130° to 140° C. until it no longer gives off the vapour of water. The temperature is then raised, and the liquid collected that distils between 180° and 185° C.

Pelletierine so obtained is colourless, but in the open air or in flasks incompletely filled it becomes coloured very rapidly. At zero its sp. gr. is. 0·999 and at 21° C. 0·985. It is very soluble in water, with which it undergoes a contraction of volume, a mixture of 1 part of pelletierine with 2·5 parts of water having at 21° C. a sp. gr. of 1·021.

Pelletierine is dextrogyre, having in aqueous solution a rotatory power of $[a]_J = +80$, that of the sulphate prepared with the distilled alkaloid is + 5·98. With sulphuric acid and potassium bichromate pelletierine gives a green colour as intense as alcohol under the same conditions.

Analyses of the alkaloid as well as of the crystalline salts that it forms with sulphuric and hydrochloric acids indicate the

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formula $C^8H^{15}NO$. It therefore furnishes another example of a volatile oxygenated base, near to conhydrine, $C^8H^{17}NO$ and tropine, $C^8H^{15}NO$. From some experiments made by Tanret it appears that the bark of the fibrillæ of the roots contains by far the largest proportion of alkaloid, *viz.*, 2·25 per cent. when dry. Tanret subsequently obtained from the bark a second alkaloid, *isopelletierine*, having anthelmintic properties, and two inactive alkaloids.

Commerce.—Pomegranate root bark is seldom to be met with in the shops, as few gardens are without the plant; it is freshly dug when required. The rind is brought to Bombay from the Persian Gulf ports chiefly. Value, Re. 1⅛ per maund of 37½ lbs. The dried seeds are also imported.

ONAGRACEÆ.

JUSSIÆA SUFFRUTICOSA, *Linn.*

Fig.—*Rheede Hort. Mal. ii.*, *t.* 50 ; *Lam. Ill.*, *t.* 280, f. 3.

Hab.—India, Ceylon. The plant.

Vernacular.—Làl-bon-lavanga (*Beng.*), Ban-laung (*Hind.*), Pána-lavanga (*Mar.*), Nir-kirambu (*Tam.*), Kavacula (*Can.*), Hæmarago (*Cingh.*).

History, Uses, &c.—Rheede under the name of *Carambu* describes this plant as medicinal, and gives as its Sanskrit name Bhállavi-anga; no such name, however, appears in the list of plants mentioned by Sanskrit writers. Bhállavi is the name of a man, and Bhállavi-anga would signify "having a body like Bhállavi." According to Rheede a decoction of this plant is used in Malabar to dissipate flatulence, act as a diuretic, purge the body and destroy worms; when ground small and steeped in butter-milk it is administered in dysentery. Ainslie quotes Rheede, and says that the plant is called *Hœmarago* in Ceylon. Miller, he says, has noticed the resemblance of its fruit to the clove, and in Jamaica *J. repens* is used as an astringent in spitting of blood and flux. (*Mat. Ind. ii.*, 66.) The plant is

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also noticed by Loureiro (*Fl. Cochin.* 226) under the name of *Epilobium fruticosum*. The Indian vernacular names all bear testimony to the resemblance of the fruit to a clove, and the Marathi name "water-clove" indicates the habitat of the plant, which is similar to that of our European willow herb (*Epilobium angustifolium*). The astringent properties of Jussiæa appear to be known to the peasantry in most parts of India.

Description.—An erect, branching, suffruticose plant, 4 to 6 ft. Leaves 3 by ¾ in., more or less villous, ovate-lanceolate, sometimes nearly linear, shortly petioled or sessile. Pedicel very short. Calyx-lobes broadly lanceolate or ovate. Petals 4, yellow, obovate. Capsule 1-2 in., linear-cylindric, more or less villous, 8-ribbed, membranous, breaking up between the ribs.

SAMYDACEÆ.

CASEARIA ESCULENTA, *Roxb.*

Fig.—*Bedd. Fl. Syl.*, *t.* 208.

Hab.—Malabar, Bombay to Coorg, Ceylon.

Vernacular.—Mora-ágerú, Bithori, Pingri, Mormassi (*Mar.*), Sátaganda (*Goa.*), Gundu-gungura (*Tel.*), Kaddlashingi, (*Tam.*), Chilla, Chilara, Bairi (*Hind*).

History, Uses, &c.—The species of Casearia found in India are not numerous, most of the genus being natives of America, where several species are used medicinally. *C. esculenta* is a small shrub of very variable appearance and not unlike the species *tomentosa* figured by Rheede (*Hort. Mal.* *v.*, 50) which he calls *Tsjerou-kanelli,* and for which he gives the following synonyms.—Fruita caurins do mato (*Port.*), "Wild cowrie fruit," Wilde dwerg appelen (*Dutch*), "Wild dog apple." Bedonsi (*Brah.*).

Roxburgh tells us that the roots of *C. esculenta* are used as a purgative by the inhabitants of the Circar hills, that he tried unsuccessfully to extract a colouring matter from the fruit, and that the young leaves are eaten in stews.

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In Western India the root has a great reputation as a remedy for hepatic enlargements and for piles. A decoction made by boiling 90 to 120 grains of it for a dose in a pint of water down to one quarter of a pint is administered internally three times a day, and a paste made by braying the root on a stone is sometimes applied locally as well when piles are present. The administration of the drug promotes the action of the liver, and the local application may be of use as the root is astringent. The Marathi word मोड (*mora*) signifies a pile, and आगेरू (*ágeru*) the intestinum rectum. Sátaganda is compounded of सात (*sáta*) seven, and गंड (*ganda*) a ring, and is applied to this plant because the transverse section of the largest roots shows seven concentric dark rings. Mormassi is a compound of Mora with a corruption of the Sanskrit मषी (*mashi*), which signifies a soft tumour. The root has long been known as a drug used by the Goanese in Bombay, but its source was only accidentally discovered in 1888 when breaking up some waste land for cultivation. In native practice the root is administered in decoction with garlic, and sometimes the leaves and root are given on the Western coast. We have received the root from Dr. P. S. Mootooswamy of Tanjore, who states that it is used in the South as a remedy for diabetes, for which disease it is considered to be a specific. An extract of the root has been administered by us in doses of from 10 to 20 grains or more in a number of cases of chronic hepatic congestion with decided benefit; it removes the feeling of weight and tension in the hepatic region and acts as a gentle aperient upon the bowels. A syrup of the strength of 20 grains of extract in two fluid drachms has also been found to be an efficient preparation.

Description.—The root is from ½ to 2 inches in diameter, often very crooked, forming angular bends; it consists of a central red woody column, having seven or a less number of dark concentric rings. The bark is of a deep dull-red colour, thick, and extremely hard, it is covered with a thin papery suber of an ochre-yellow colour. The taste is astringent. The root yields to water an abundant dark reddish-brown extract.

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The powder has a cobweb-like character due to the length and silkiness of the liber cells.

Chemical composition.—Operating upon the root-bark, ether removed 3 per cent. of brownish-yellow resin, partly soluble in spirit, with a neutral reaction. Alcohol extracted about 13 per cent. of dark-red colouring matter consisting mostly of tannic acid. This extract was only partly soluble in water, the insoluble portion became clear with ammonia, but the liquid rapidly pectinised. The tannic acid gave a brownish-green colour with ferric salts. The aqueous extract was also dark coloured, and nearly half of it was precipitated by neutral plumbic acetate as one or more organic acids. This extract and that part of it forming a lead compound was tested physiologically and found to have a cathartic effect; the lead compound gave 53·5 per cent. of Pb O, and the acid separated from lead by sulphuretted hydrogen possessed some of the characters of cathartic acid. The portion of aqueous extract not precipitated by lead contained a neutral principle crystallizing in white transparent prisms. The root had still another colouring matter removed by soda solution, a small quantity of starch, and it left 4·8 per cent. of mineral matter when burnt. The tannin of Casearia root is related to Ratanhia-tannic acid, in the composition of its lead salt and in yielding a crystalline sugar when boiled with acids. The insoluble tannin is also similar to the Ratanhia red.

PASSIFLOREÆ.

CARICA PAPAYA, *Linn.*

Fig.— *Bot. Reg.* 459. Papaw (*Eng.*), Papayer (*Fr.*).

Hab.—America. Cultivated throughout India. The milky juice.

Vernacular.—Papiya, Arand-kharbuz (*Hind.*), Painpai (*Beng.*) Papai (*Mar.*), Pappali-maram (*Tam.*), Bapaia-pandu (*Tel.*), Parangi (*Can.*)

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History, Uses, &c.—In the Brazils the hermaphrodite variety of *C. Papaya* is called mamao macho (male mamao), the fruit-bearing variety mamao femea (female mamao), and a cultivated variety of the latter mamao melao (melon mamao). The anthelmintic properties of the milky juice were first noticed in the 17th century by Hernandez. Its digestive action upon meat was probably known in the West Indies at a very early date, and appears to have been communicated to the inhabitants of India upon the introduction of the tree by the Portuguese, as it has long been the practice to render meat tender by rubbing it with the juice of the unripe fruit or by wrapping it in the leaves. The author of the Makhzan-el-adwiya (A.D. 1770) accurately describes the tree, and mentions the use of the juice, mixed with that of fresh ginger, for making meat tender. Medicinally, he says, it is a remedy for hæmoptysis, bleeding piles, and ulcers of the urinary passages; it is also useful in dyspepsia; rubbing the milk in two or three times cures ringworm, or psoriasis (قوبا) causing a copious serous exudation attended with itching. (*Op. cit. sub voce Papiya.*) The attention of the profession in India was called to the use of the milk as an anthelmintic in 1810 by Dr. Fleming (*Asiatic Researches*, Vol. XI.), who cites an interesting passage from the writings of M. Charpentier Cossigni in support of its alleged virtues. Further confirmatory evidence has more recently been adduced by M. Bouton (*Med. Plants of Mauritius*, 1857, p. 65), and it may justly be concluded that the statements as to its efficacy as an anthelmintic are founded on fact. The following mode of administration employed by the late Dr. Lemarchand, of the Mauritius (cited by Bouton), it would be desirable to adopt in all future trials with this remedy. Take of fresh Papaw milk, honey, of each a tablespoonful; mix thoroughly, gradually add three or four tablespoonfuls of boiling water; and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil, to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively if required. The above is a dose for an adult; half

the quantity may be given to children between 7 and 10 years of age; and a third or teaspoonful to children under 3 years. If it cause griping, as it occasionally does, enemas containing sugar have been found effectual in relieving it. Taking the dose above named as correct, the statement of Sir W. O'Shaughnessy (*Bengal Dispensatory*, p. 352), that he had administered the milky juice as an anthelmintic, in doses of from 20 to 60 drops without obvious effect, is fully explained. It is principally effectual in the expulsion of lumbrici. On tænia it is reported to have little effect. Anthelmintic virtues have also been assigned to the seeds, but the evidence of their efficacy is very inconclusive. A belief in their emmenagogue properties prevails amongst all classes of women in Southern and Western India, and also in Bengal; so much so, that they assert that if a pregnant woman partake of them, even in moderate quantities, abortion will be the probable result; the same prejudice exists against eating the fruit. Facts in support of the alleged emmenagogue properties of the Papaw are still wanting. (*Phar. of India*, p. 97.) Lt.-Col. Cox has brought to the notice of the Madras Agri-Horti-cultural Society that the leaves are used in the south to extract guinea-worms; an ounce of the leaf is rubbed with 60 grains of opium and 60 grains of common salt, and the paste applied to the part. "Of course the worm has to be wound out in the usual manner, but it always comes out more quickly and easily when treated in this way."

Evers has employed the milk in the treatment of splenic and hepatic enlargement with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily. (*Ind. Med. Gaz., Feb.* 1875.) In 1877, the milky juice began to attract attention in Europe as a digestive ferment, and Herr Wittmack (1878) examined its properties with the following results:—He obtained, after repeated incision of a half ripe fruit, 1·195 grammes of white milky juice of the consistence of cream. This dried in a watch glass to a hard vitreous white mass, having what appeared to be greasy spots on the surface, but which really were flocks of a gelatinous substance that always adheres to the more hardened material.

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The odour and flavour of the fresh juice recalled that of petroleum or of vulcanised india-rubber. The microscope showed it to be a fine grumous mass containing some larger particles and isolated starch grains. Iodine coloured the juice yellowish brown. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments made without the juice the boiled meat was visibly harder. Hard boiled albumen, digested with a little juice at a temperature of 20° C., could after twenty-four hours be easily broken up with a glass rod. 50 grammes of beef in one piece, enveloped in a leaf of *C. papaya* during 24 hours at 15° C., after a short boiling became perfectly tender; a similar piece wrapped in paper and heated in the same manner remained quite hard. Some comparative experiments were also made with pepsin, and the following are the conclusions arrived at by the author :—

(1) The milky juice of the *Carica papaya* is (or contains) a ferment which has an extraordinarily energetic action upon nitrogenous substances, and like pepsin curdles milk; (2) this juice differs from pepsin in being active without the addition of free acid, probably it contains a small quantity, and further it operates at a higher temperature (about 60° to 65° C.) and in a shorter time (5 minutes at most); (3) the filtered juice differs chemically from pepsin in that it gives no precipitate on boiling, and further that it is precipitated by mercuric chloride, iodine, and all the mineral acids; (4) it resembles pepsin in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron. (*Pharm. Jour., Nov.* 30, 1878.)

The active principle has since been separated and given the name of *Papain*; it is now an article of commerce in Europe for medicinal purposes, and is said to be capable of digesting 200 times its weight of fibrin; it has been used as a solvent of diphtheritic false membrane, and also as a local application

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in old standing cases of chronic eczema, more especially of the palms of the hands, and where other remedies failed great benefit has attended its application in the following way:—12 grains of papain, and 5 grains of powdered borax, in 2 drachms of distilled water, to be painted on the parts twice daily.

In the *Therapeutic Gazette* (1886), Dr. A. Jacobi records successful results in several cases in which papain was applied topically to diphtheritic membranes. In these cases a mixture of one part of papain and two parts each of glycerine and water were applied with a brush; within twelve hours the membrane began to slough off, and was freely expectorated. Similar results were obtained in England a few years before this, but a want of uniformity and hence uncertainty to a certain extent prevented the remedy coming into general use.

Dr. George Herschell (*Brit. Med. Journ.*, 1886, p. 640,) records the treatment of the chronic stomach catarrh of children with powders composed of *Papain-Finkler*, gr. ½ to 1; Sacch. lactis, gr. i; Sodii Bicarb., gr. v., to be taken after every meal. This relieves the aggravating symptoms of dyspepsia, such as loss of appetite and sleep, irritability, headache, and sometimes a cough, which so much affect children. Dr. Herschell believes that the remedy acts by dissolving the mucus, which accumulates in unusual quantity upon the stomach and intestines and prevents absorption of food. In the acid dyspepsia of adults, when heartburn and flatulence are the chief indications of impaired digestion, he finds papain valuable in conjunction with carbolic acid and an alkali, as in the following draught:—Sodii Bicarb. gr. xv., Glycer. acid. carbolic., m. viii.; Spt. Ammon. Arom., m. xx., Aquæ ad ℥iss. This is to be taken an hour after food along with 2 grains of Papain-Finkler. (*Chem. and Druggist*, 1886.)

Description.—The tree is from 20 to 30 feet high, without branches when young, but old trees often produce a number of separate heads. The leaves are alternate, palmate, 7-partite; segments oblong, acute, sinuated, the middle one 3-fid; corolla tubular in the male and 5-lobed in the female,

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divided nearly to the base into five segments; male flowers axillary in slightly compound racemes or panicles, white; female generally on a different tree, in the axils of the leaves, large and fleshy, yellowish; fruit succulent, oblong, furrowed; the size of a small melon, yellowish-green when ripe, and containing a number of round, grey, slimy seeds, which smell like cress. In the unripe state the fruit abounds in a thick milky juice.

Chemical composition and Physiological action.—The fruit has been examined by Dr. T. Peckolt (*Zeitschr. des Oesterr. Apoth. Ver.* 1879, 361—373); it was gathered in the full-grown but unripe condition, when it contains a considerable quantity of milky juice, which disappears almost entirely after it has been kept for a few days. The analysis of the fresh fruit of the three varieties freed from acid gave the following numbers:—

	Fruit of female plant.	Fruit of female cultivated plant.	Fruit of Hermaphrodite plant.
Caoutchouc-like substance	......	......	0·046
Soft yellow resin	0·165	......	......
Reddish yellow fat	......	0·020	......
Albuminoids	1·070	0·500	0·735
Sugar	3·238	3·560	4·338
Pectinous matter	1·315		
Tartaric acid } Combined with bases.	0·075		
Citric acid } Combined with bases.	0·020	0·483	2·332
Malic acid } Combined with bases.	0·083		
Dextrin, &c.	5·503		
Water	85·351	92·500	89·445
Cellulose	3·180	2·920	5·091

The fresh fruit of the female plant gave 1·239 per cent. of ash, and the dried fruit 8·457 per cent. It contained a large amount of soda, potash, and phosphoric acid. The ripe fruit contained no free acids.

The seeds contain an oil, *papaya oil; caricin*, an oil-like substance with a disagreeable taste and smell, soluble in ether and alcohol; an acid similar to palmitic acid, *Carica fat acid*; a crystalline acid, *Papayic acid,* insoluble in cold water, but

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soluble in hot water and alcohol; a resin acid, having an irritating and bitter taste, insoluble in water and ether, soluble in alcohol and alkalies; and a soft resin similar to that found in the fruit flesh of the female plant. (*Year-Book of Pharmacy*, 1880, p. 212.) Dr. Sidney Martin (*Journ. Physiol.* V., 213—230, and VI., 336—360; *Journ. Chem. Soc.* 1886, 641,) has shown papain to be a protolytic ferment, which acts very similarly to trypsin.

Experiments performed with fibrin and white of egg showed that some degree of digestion occurs when the liquid is faintly acid (0·05 per cent. of HCl); the presence of more acid than this hinders the action of the ferment. Digestion takes place actively only in neutral or in alkaline solutions (0·25 per cent. of sodium carbonate); it occurs most readily at a temperature between 35° and 40° C. The results of digestion are peptones, leucine and tyrosine and an intermediate globulin-like substance, similar to that formed in pancreatic digestion.

In the author's second paper on the same subject the ferment in papaw juice is shown to be associated with an albumose, and to give the following reactions in addition to those previously described by Wurtz:—The solution gives a biuret reaction, and it is precipitated from a neutral solution of sodium, magnesium sulphate or sodium chloride alone, as globulins are.. It is soluble in glycerol, and if precipitated from this solution by alcohol, the filtrate has no proteolytic power. The kind of albumose is one nearly akin to the protalbumose of Kühne and Chittenden, and is called α-phytalbumose. Papaw juice also contains a milk-curdling ferment. The proteids present in papaw juice were found to be as follows:—

(1) Globulin, resembling serum globulin in its most important properties.

(2) Albumin.

(3) β-phytalbumose precipitated almost completely by heat, by saturation with neutral salts, but not by dialysis. It differs from the heteroalbumose of Kühne and Chittenden by not being precipitated by dialysis, by copper sulphate, or by mercuric chloride.

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(4) α-phytalbumose; soluble in cold or boiling water; not precipitated by saturation with neutral salts, except in an acid solution. This is the vegetable peptone referred to by Vines (*Journ. Physiol.* iii.) as hemialbumose. It differs from the protalbumose of Kühne and Chittenden by its non-precipitation by sodium chloride or by copper sulphate. Both these albumoses give the biuret reaction.

No peptones occur in the juice, but leucine and tyrosine are present. By a series of digestion experiments carried out on each of these proteids by papain in a neutral liquid, it was found that both the globulin and albumen are changed into β-phytalbumose, and that this becomes a peptone-like substance, and forms leucine and tyrosine. The α-phytalbumose becomes a similar peptone-like substance, leucine and tyrosine being formed. This peptone-like substance resembles the deuteroalbumose of Kühne and Chittenden, except that a solution of it, when rendered acid by acetic acid in the presence of sodium chloride, does not become cloudy on warming. No true peptones are formed. Probably digestion in the plant itself is very slow, as much more liquid was used in the experiments than is present in the juice. The albumose forms probably the circulating proteid in the plant. (*Year-Book of Pharm.*, 1886, p. 97).

CUCURBITACEÆ.

CITRULLUS COLOCYNTHIS, *Schrad.*

Fig.—*Wight Ic., t.* 498; *Bentl. and Trim.*, 114. Bitter apple (*Eng.*), Coloquinte (*Fr.*).

Hab.—India, Asia, Africa. The fruit and root.

Vernacular.—Indráyan (*Hind.*), Indráyan (*Guz.*), Peykomatti, Tumatti (*Tam.*), Kuruvrandawan (*Mar.*), Eti-puchcha, Chittipápara (*Tel.*), Dodda-hal-mekki (*Can.*), Indráyan (*Beng.*).

History, Uses, &c.—Wild colocynth is common in waste tracts of North-West, Central and South India, and

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ripens in the cold season. Aitchison observes that it is very common all over the desert country of Beluchistan, where it is called *Khar-kushta*. The fresh fruit is brought for sale by the herbalists; it is grown in the North-West Provinces for the use of the Government Sanitary Establishments.

Sanskrit writers describe the fruit as bitter, acrid, cathartic and useful in biliousness, constipation, fever and worms. They also mention the root as a useful cathartic in jaundice, ascites, enlargements of the abdominal viscera, urinary diseases, rheumatism, &c. Sarangadhara gives a receipt for a compound pill, which contains Mercury 1 part, Colocynth pulp, Sulphur, Cardamoms, Long Pepper, Chebulic myrobalans, and Pellitory root, of each 4 parts. The Sanskrit names for colocynth are Indravárunì and Vishálá. In India the fruit or root, with or without nux vomica, is rubbed into a paste with water and applied to boils and pimples. In rheumatism equal parts of the root and long pepper are given in pills. A paste of the root is applied to the enlarged abdomen of children. (*Compare with Scrib. Comp.* 80, *and Pliny* 20, 8.)

Mahometan writers call the colocynth plant Hanzal, and discuss its properties at great length. They consider it to be a very drastic purgative, removing phlegm from all parts of the system, and direct the fruit, leaves and root to be used. The drug is prescribed as with us, when the bowels are obstinately costive from disease or lesion of the nervous centres, also in dropsy, jaundice, colic, worms, elephantiasis, &c. Its irritant action upon the uterus is noticed, and fumigation with it is said to be of use for bringing on the menstrual flow.* The author of the Makhzan describes a curious method of administration. A small hole is made at one end of the fruit and pepper-corns are introduced, the hole is then closed, the fruit enveloped in a coating of clay and buried in the hot ashes near the fire-place for some days; the pepper is then removed and used as a carminative aperient. A similar preparation is made with rhubarb root instead of pepper. The same author tells us that the seeds are purgative, and mentions their use for preserving the

* Compare Hippocrates de morb. mulier. ii., 50.

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hair from turning grey, a purpose for which "*bitter apples*" are apparently employed in England in the present day. As regards the purgative properties of the seeds he is incorrect, for when thoroughly washed they are eaten by the Arabs in time of famine. Colocynth was familiar to the Greeks and Romans.*

Description.—The Indian fruit is nearly globular, of the size of an orange, smooth, marbled with green and yellow when fresh, yellowish-brown when dry, and contains a scanty greyish-white pulp in which a number of brown seeds are embedded. This pulp in the fresh fruit is spongy and juicy, and occupies the whole of the interior of the fruit. Peeled colocynth is unknown in the Indian market except as an import from Europe. The seeds are disposed in vertical rows on three thick parietal placentæ, which project to the centre of the fruit, then divide and turn back, forming two branches directed towards one another. The seeds are of flattened ovoid form, 3-10ths of an inch long by 2-10ths broad, not bordered. The testa is hard and thick, with a finely-granulated surface, and is marked on each side of its smaller end by two furrows directed towards the hilum. The leaves are glabrous and nearly smooth above, muricated beneath, with small, white, hair-bearing tubercles, many cleft and lobed, the lobes obtuse. The root is fibrous, tough and stringy, of a yellowish-white colour. All parts of the plant are very bitter, and the dust when dry very irritating to the eyes and nostrils.

Chemical composition.—The bitter principle was isolated by Hübschmann in 1847, by Lebourdais in 1848, and by Walz (1858), who treated alcoholic extract of colocynth with water, and mixed the solution firstly with neutral acetate of lead, and subsequently with basic acetate of lead. From the filtered liquid the lead was separated by means of sulphuretted hydrogen, and then tannic acid added to it. The latter caused the colocynthin to be precipitated; the precipitate washed and dried

* κολοκύνθίς, Theophr. H. P. i., 19, 22. vii., 1, 3, 6; Dios. iv., 171; Colocynthis, Plin. 20, 8.

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was decomposed by oxide of lead, and, finally, the colocynthin was dissolved out by ether.

Walz thus obtained about ¼ per cent. of a yellowish mass or tufts, which he considered as possessing crystalline structure, and to which he gave the name *colocynthin*. He assigns to it the formula $C^{56} H^{84} O^{23}$. Colocynthin is a violent purgative.

Colocynthin is decomposed, according to Walz, by boiling dilute hydrochloric acid, and then yields *colocynthein*, $C^{44} H^{64} O^{13}$, and grape sugar.

The same chemist termed *colocynthitin* that part of the alcoholic extract of colocynth, which is soluble in ether, but not in water. Purified with boiling alcohol, colocynthitin forms a tasteless crystalline powder.

The pulp perfectly freed from seeds and dried at 100°C., affords 11 per cent. of ash; the seeds alone yield only 2·7 per cent. (*Pharmacographia.*) The seeds contain after decortication about 48 per cent. of fatty oil and 18 per cent albuminous substances besides a small quantity of sugar. (*Flückiger.*)

We have examined the roots dried at 50° C., and reduced to powder; the powder contained a large amount of starch and woody fibre; for the chemical examination, no separation of fragments of woody fibre by a sieve was attempted, the powdered roots being used as a whole.

Dry ether was digested with a known weight of the powder for some days, and was found to extract ·14 per cent. only. The extractive was of a yellow colour, bitter, and consisted chiefly of oily matter. Water digested with this extract acquired a very bitter taste. Another portion of the powder was exhausted with 84 per cent. alcohol, by which treatment 12·62 per cent. of a soft yellow non-crystalline extract was obtained dried at 100° C.

By the action of cold water on the extract, ·88 per cent. of insoluble, soft yellow residue was left; this residue was not bitter, and its alcoholic solution had a marked acid reaction. It had the properties of a fat acid. The aqueous extractive was somewhat milky; repeated filtration failed to make it bright: it

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was acidulated with acetic acid and agitated with acetic ether. The acetic ether extract was yellow and most intensely bitter, it amounted to ·3 per cent. calculated on the roots. The greater part of this extract was soluble in water, the solution being intensely bitter. The residue insoluble in water consisted of fatty matter, and after repeated washing with water, it still had a bitter taste. The aqueous solution of the acetic extract gave with tannic acid a white curdy precipitate.

Acetic ether appears to be a better solvent for colocynthin than light petroleum ether, and it can be separated from either an acid or alkaline solution by the reagent. The acetic ether extract soluble in water may be looked upon as crude colocynthin. Henke appears to have obtained about ·6 per cent. of colocynthin from the commercial drug freed from seeds, while Walz obtained about ·25 per cent.

Commerce.—In the months of December and January fresh colocynth fruit is brought into the towns for sale. The dried entire fruit is sold in the shops. Large parcels collected and dried up-country sometimes make their appearance in the drug market. Average value, Re. 1 per 100 fruits. The fruit supplied from Saharunpore, N.-W. Provinces, in no way differs from that collected in the Deccan.

The extract prepared in India for use in the Government hospitals is made from the dry fruit after the seeds have been shaken out, as the scanty pulp cannot well be separated from the rind. This extract is quite as active as the best quality obtainable in Europe. The yield is about 110 lbs. of the compound extract from 60 lbs of dried fruit.

CITRULLUS VULGARIS, *Schrad.*

Fig.—*Hook. Kew Journ. Bot., iii., t.* 3. Water-melon (*Eng.*), Melon d'eau (*Fr.*)

Hab.—Cultivated throughout the East. The seeds.

Vernacular.—Tarbuj (*Hind.*), Tarmuj (*Beng.*), Kalingada (*Mar.*), Pitcha-pullum (*Tam.*), Kárigu (*Guz.*).

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History, Uses, &c.—The distinction between the Water-melon and the cultivated form of *C. Colocynthis* is very small. The water-melon has either sweet or bitter fruit: when the latter, it is the *Citrullus amarus* of authors. *C. fistulosus*, Stocks, has thick stems, leaves sparingly lobed, and is plentifully supplied with long somewhat hispid hairs. (*Fl. Br. Ind.*) In India a small cultivated variety of *C. vulgaris*, known as *Dilpasand*, is commonly cultivated as a vegetable; it is globular, about as large as colocynth fruit, does not become sweet when ripe, and is used in the same manner as the Vegetable Marrow. The seeds of the water-melon are of interest as being one of the four cold cucurbitaceous seeds of the ancients, which, according to Guibourt, were originally those of *Cucumis sativus*, L., *Cucumis Citrullus*, DC., (the water-melon), *Cucumis Melo*, L., and *Lagenaria, vulg. clavata*, DC., but he remarks that in Paris the seeds of *Cucurbita Pepo*, Duch., and *Cucurbita maxima* (the *potiron* of the French) are now substituted for those of *Cucumis Citrullus* and *Lagenaria vulgaris*. In India the four cold cucurbitaceous seeds sold in the bazars are those of *Cucumis utilissimus*, *Benincasa cerifera*, *Cucumis Melo*, and *Citrullus vulgaris*. These seeds are in constant demand, and are kept decorticated and ready for use. The natives always use them together, and consider them to be cooling, diuretic, and strengthening. They are sold for about Re. ¾ per pound. The juice of the water-melon is used with cumin and sugar as a cooling drink. In Sind the dried fruit of *Citrullus amarus*, under the name of *Kirbut*, is used as an emetic, and in small doses with honey as a stomachic for children. (*Murray.*) Popularly the use of water melons is supposed to be specially conducive to choleraic seizures, but the evidence upon which this opinion is based appears to us wholly inconclusive. According to Brannt the seeds of this melon are brought from Senegal to France, where they are pressed, yielding as much as 30 per cent. of a fluid pale yellow oil which is used as a table oil and in the manufacture of soap.

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CUCUMIS TRIGONUS, *Roxb.*

Fig.—*Wight Ill.*, *t.* 105; *Ic.*, *t.* 497; *Rheede, Hort. Mal.* viii., 11. Var. pubescens, *Royle Ill.*, *t.* 47; *Wight Ic.*, *t.* 496.

Hab.—India. The fruit.

Vernacular.—Bislambhi (*Hind.*), Káttut-tumatti (*Tam.*), Adavi-puchcha (*Tel.*), Kátvel, Kárit (*Mar.*), Hal-mekki (*Can.*).

Var. pubescens, Takmaki (*Mar.*).

History, Uses, &c.—This plant occurs in two very distinct forms, the wild bitter form has smooth fruits about the size and shape of a small egg, marked with green and yellow streaks like colocynth. The pubescent or semi-cultivated form has velvety fruits which are quite sweet when ripe, and are eaten as a vegetable when green. The wild fruits are never eaten, but are used sometimes medicinally in the same way as *Citrullus amarus.* The seeds are considered very cooling, and are beaten into a paste with the juice of *Cynodon dactylon* (Durva) and applied to herpetic eruptions.

The bitter gourd, is like colocynth, called Vishálá in Sanskrit, and is brought for sale in the Concan at the feast of the Divali or new year of the Hindus, as there is a custom at that season of crushing it under the foot and then applying it to the tongue and forehead to avert disease during the new year. This custom is unknown in the Deccan.* In Malabar the plant is

* Dr. R. G. Bhandarkar informs us that a Kârit is crushed after the ceremonial bath early in the morning on the Naraka Chaturdasî, or the first day of the Divâlî. The religious manuals usually consulted direct the whirling round oneself while bathing of a twig of Apâmârga (*Achyranthes aspera*), of Tumbî (*Leucas zeylanica*) and of Prapunâṭa or Chakramarda (*Cassia Tora*), and in the verse that is repeated on the occasion, the Apâmârga is prayed to to remove sins. Probably some purificatory properties were observed in these three plants, and on that account the power of spiritual purification was also attributed to them. But the idea associated with the Kâriṭ does not seem to be this. It is probably the same as that which underlies the practice of eating Nimba leaves on new year's day or the Varshapratipadâ. These leaves are bitter and supposed to improve the digestive power; by eating them, therefore, one clears off the indigestions of the previous year, and fits oneself for entering on another year's course. The Kâriṭ being bitter, probably came to be used for the same reason, especially as one has to eat a great many sweet things during the Divâlî festival. The religious manuals do not prescribe the use of Kâriṭ or even allude to it.

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supposed to be alexipharmic, and to have the power of removing all pains and aches. The fruit pounded or boiled with cow's milk and applied to the head is supposed to prevent insanity, strengthen the memory, and remove vertigo. It is the Balia-mucca-piri of Rheede, who gives *Tindalica* as the Portuguese, and *Milten* as the Dutch name. His brahminical name *Carinti* is Marathi, and most of his brahminical names are derived from the South Concan dialect of that language, showing that he obtained his information concerning the medicinal properties of plants from Shenvi and Sarasvat Brahmins who had migrated to Malabar from the Southern Concan. Modern investigation has shown that the medicinal properties of this gourd in no way differ from those of colocynth.

Chemical composition.—The dried fruit was digested with 84 per cent. alcohol, and the resulting tincture concentrated until most of the alcohol had been expelled; water was then added, and the mixture agitated with petroleum ether. The petroleum ether extract consisted of a soft dark reddish brown residue, which left a greasy stain on paper: with the exception of a few flocks it was soluble in alcohol, with acid reaction and bitter taste. On allowing the alcoholic solution to evaporate, some small warty masses separated which were destitute of crystalline structure under the microscope. After agitation with petroleum ether, the aqueous solution, still containing some alcohol, was heated on the water bath to drive off all the spirit, and the soft extract was then mixed with water and agitated with acetic ether containing some acetic acid. The acetic ether extract was reddish brown, very bitter and partly soluble in boiling water. The insoluble residue was brittle when cold and very bitter, and had the properties of a resin, and would appear to correspond with the *resin of colocynth* described by Meissner and others.

The aqueous solution obtained by the action of boiling water on the acetic ether extract was cooled and mixed with aqueous tannic acid, and the curdy precipitate separated by filtration and slightly washed; thorough washing was not possible owing to the precipitate caking on the sides of the filter. The drained

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but still moist precipitate together with the filter was now well triturated with freshly precipitated carbonate of lead and the creamy mixture dried. The dry residue was boiled with alcohol, and on evaporating off the alcohol a slightly yellow amorphous residue was left, brittle when cold and easily reduced to a slightly yellow powder, which possessed an extremely bitter taste. On spontaneous evaporation of an alcoholic solution, a crystalline residue was obtained, in which prisms were detected on microscopic examination. Generally the reactions afforded by this bitter principle agreed with those usually ascribed to colocynthin. It failed, however, to yield any *dark green greasy precipitate* with boiling aqueous hydrochloric acid, as is mentioned in Muir and Morley's edition of *Watts' Chemical Dictionary.* We further tested a sample of colocinthin, which had been obtained from Dr. Schuchardt of Görlitz, for this reaction, but with negative results. Regarding the production of this dark green greasy precipitate; on boiling colocynthin with concentrated aqueous hydrochloric acid, the first effect of heat was the formation of a clear reddish yellow solution; on continued ebullition the liquid became darker and turbid, and on the surface a dirty white scum appeared, wholly destitute of any green tinge, and on diluting with water, the scum became of a light reddish dirty tint.

The dried fruit with a few seeds lost 12·22 per cent. when heated to 100° C. The ash amounted to 9·74 per cent.

LAGENARIA VULGARIS, *Seringe.*

Fig.—*Rheede Hort. Mal. viii., t.* 5; *Wight Ill., t.* 105. The bottle gourd (*Eng.*).

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Tumba, Belaschora-tumbi, Karwa-tumba (*Hind.*), Tikta-lau (*Beng.*), Karu-bhopala, Bhopala (*Mar.*), Shorakai (*Tam.*), Anapa-kai (*Tel.*), Gara-dudi (*Mal.*).

History, Uses, &c.—The shell of this gourd when dried is much used in the East as a vessel for holding fluids

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of all kinds, and for making the native guitar or *Tambura.* The fruit often attains an enormous size, and is used as a buoy for crossing rivers and transporting baggage. Amongst the Hindus as amongst the Greeks gourds are considered to be emblematic of fecundity, prosperity, and good health. There are two varieties of the bottle gourd, a sweet one, called in Sanskrit *Alábu,* and a bitter one known as *Katutumbi.* The fruit varies much in shape. The outer rind is hard and ligneous, and encloses a spongy white flesh, very bitter, and powerfully emetic and purgative. The seeds are grey, flat, and elliptical, surrounded by a border which is inflated at the sides but notched at the apex; their kernels are white, oily, and sweet. In India the pulp in combination with other drugs is used in native practice as a purgative; it is also applied externally as a poultice. The seeds were originally one of the four cold cucurbitaceous seeds of the ancients, but pumpkin seeds are now usually substituted for them.

The Hindus administer a decoction of the leaves in jaundice; it has a purgative action.

Toxicology.—Dr. Burton Brown notices the poisonous properties of the bitter variety of this gourd, the symptoms observed being similar to those after poisoning by elaterium or colocynth.

BENINCASA CERIFERA, *Savi.*

Fig.—*Rheede Hort. Mal. viii., t.* 3.

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Petha (*Hind.*), Kumra (*Beng.*), Kohala (*Mar.*), Búrda-gúmúdu (*Tel.*), Bhurun-koholun (*Guz.*), Kumbuli (*Tam.*), Kuvali (*Mal.*).

History, Uses, &c.—Dutt in his Hindu Materia Medica gives us the following account of the medicinal use of this gourd which is called Kushmánda in Sanskrit:—" The fruit is considered tonic, nutritive and diuretic, and a specific for hæmoptysis and other hæmorrhages from internal organs. It

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would appear that the old Sanskrit writers were not acquainted with its peculiar action on the circulatory system by which it rapidly puts a check to hæmorrhage from the lungs. The Raja Nirghantu, the oldest work on therapeutics, gives a long account of its virtues, but does not allude to its use in phthisis or hæmoptysis. Neither does Susruta mention it in his chapters on the treatment of hæmorrhage and phthisis, though the plant is alluded to by him elsewhere. The more recent compilations, such as Chakradatta Sangraha, Sarangadhara, &c., give numerous preparations of the article; of these Khanda Kushmándaka or the confection may be taken as an example. In preparing this medicine, old ripe gourds are selected. Those not at least a year old are not approved. They are longitudinally divided into two halves, and the pulp scraped out in thin flakes by an iron comb or scraper. The watery juice that oozes out abundantly during this process is preserved, the seeds being rejected. The pulp is boiled in the juice until soft. It is then tied up tightly in a cloth, and the fluid portion allowed to drain away. The softened and drained pulp is dried in the sun, and the watery portion preserved for future use. Fifty tolás of the prepared pulp are fried in sixteen tolás of clarified butter, and again boiled in the juice of the fruit, till reduced to the consistence of honey. To this are added fifty tolás of refined sugar, and the whole is heated over a gentle fire till the mass assumes such a consistence as to adhere to the ladle. The pot is now removed from the fire, and the following substances, namely, long pepper and ginger, each two tolás, cumin seeds, cardamoms, cinnamon, folia malabathri, black pepper and coriander, each half a tolá in fine powder, are added to the syrup and stirred briskly with a ladle, till the mass is cool. Eight tolás of honey are now added to the confection, which is preserved in a new earthen pot. The dose is from one to two tolás, according to the age and strength of the patient. It is prescribed in hæmoptysis, phthisis, marasmus, cough, asthma, &c., &c."

In the Concan this preparation is made by steaming the rind and pulp cut fine, when well softened it is tied up in a cloth

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and allowed to drain, saffron, nutmeg, cardamoms and melted sugar are then added.

In insanity, epilepsy and other nervous diseases the fresh juice of the fruit is given either with sugar or as an adjunct to other medicines. According to Dr. Savinge of Rajamundry it has been used with success in diabetes, 4 ozs. of the juice with 100 grs. each of saffron, and the bran of red rice, are given morning and evening and a strict diet enjoined.

The fruit of *B. cerifera* is sub-rotund, 12 to 15 inches in diameter, hairy when young, smooth with a whitish bloom when ripe.

TRICHOSANTHES PALMATA, *Roxb.*

Fig.—*Wight Ill.*, *tt.* 104, 105.

Hab.—Throughout India. The fruit and stem.

Vernacular.—Lal-indráyan (*Hind.*), Kaundal (*Mar.*), Mákál (*Beng.*), Koratti, Shavari (*Tam.*), Avagude (*Can.*), Kakapalam (*Mal.*), Avaguda, Abuvva (*Tel.*).

History, Uses, &c.—Sanskrit writers describe Mahákála as a kind of gourd with an exterior resembling an orange, but with pulp like cowdung. Mahákala is also a name of Ganesha, the god of wisdom, the causer and remover of obstacles, the son of Shiva and Parvati. This gourd is used as a ear ornament (kundala) for the figure of Ganesha or Ganpati, which is dressed up and seated in state in every Hindu house once a year, to bring good luck to the inmates. At this season large quantities of the fruit are brought for sale in the markets. The plant and fruit are considered medicinal. According to Ainslie, the fruit pounded and intimately blended with warm cocoanut oil is considered a valuable application for cleaning and healing offensive sores inside the ears, and is also used to cure ozæna. The root is said by Wight to be used as a cattle medicine, especially in inflammation of the lungs. In the *Bengal Dispensatory* it is stated that numerous trials were made

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with the fruit to ascertain whether it had purgative properties. Three grain doses thrice daily produced no sensible effect.

In Bombay the natives sometimes smoke it as a remedy for asthma. Sir T. Madava Row proposed in the Indian papers (1888) this remedy for the Crown Prince of Germany.—"Take the external cover of the fruit of *T. palmata*, powder it, and inhale the smoke of it, like that of tobacco. Do this three times a day for three days. This is found in an important work in Sanskrit on medicine." The root with an equal portion of colocynth root is rubbed into a paste and applied to carbuncles; combined with equal portions of the three myrobalans and turmeric, it affords an infusion which is flavoured with honey and given in gonorrhœa. *T. palmata* is supposed by some to be the *Hanzal ahmar* or red colocynth of Mahometan writers.

Description.—The fruit is round, oval, or pyriform, the size of a small apple, crimson when fresh, of a dull orange colour when dry, marked at one end by a deep cicatrix with sharp raised edges, at the other there is a prominence to which a portion of the stalk sometimes remains attached. In the dry fruit, which has a thin, brittle, very bitter shell, the segments of pulp with their seeds are loose, so that the contents of the gourd rattle. If a dry segment be soaked in water it soon softens, yielding a dark green pulp which smells like savine, and has an acrid and bitter taste. The seeds, ranging in number from 60 to 100 in each fruit, are flat, but very irregular in shape, generally somewhat triangular, and average 7-16ths of an inch in length; they have a hard blackish shell, and sweet oily kernel. The vine is perennial, often as thick as a man's arm; it has a warty grey bark, marked by seven deep longitudinal fissures, which correspond to the medullary divisions between seven wedge-shaped woody and vascular bundles into which the stem is divided. The vine is not bitter.

Chemical composition.—The rind and pulp of the fruit contain an amorphous bitter principle soluble in water and alcohol, and very slightly in ether. It gives an abundant precipitate with tannin and reduces Fehling's solution. Sulphuric acid forms,

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at first, a yellow solution passing to orange red and purple. Fröhde's reagent colours it first orange, then reddish brown, and finally greenish brown. The bitter principle resembles to some extent colocynthin, and the name "*trichosanthin*" is proposed for it. The fruits when being burnt, and when decomposing in moist situations, give off large quantities of ammonia.

The green pulp in the interior of the fruit in which the seeds are embedded, contains a colouring matter which has more of the red in its fluorescence than chlorophyll, and its spectrum shows a different arrangement of bands than is seen in the usual green colouring matter of plants. Prof. Michie Smith (*Proc. Roy. Soc. Edin.* 1890), comparing the absorption spectra of this colouring matter with chlorophyll, finds in the former two very dark bands, one in the red extending from near C to about half way between C and D, the other in the yellow on the more refrangible side of D. There are two other fainter bands, one on each side of E. The action of hydrochloric acid and ammonium sulphide upon the colouring matter alters the spectrum in a characteristic manner that completely distinguishes it from chlorophyll.

Toxicology.—Roxburgh informs us that the fruit is reckoned poisonous. The Madras Chemical Examiner (1888) reported: "A woman who is said to have eaten the seeds (fruit?) of this plant with suicidal intent, suffered from vomiting, purging, and griping, and died collapsed. No alkaloid was found in the viscera, and a portion of the fruit was found non-poisonous with a guinea-pig."

TRICHOSANTHES DIOICA, *Roxb.*

Hab.—Throughout the plain of North India, Guzerat to Assam, Bengal.

TRICHOSANTHES CUCUMERINA, *Linn.*

Fig.—*Rheede Hort. Mal. viii., t.* 15. Sabino (*Port.*), Kalpert (*Dutch*).

Hab.—Throughout India and Ceylon. The plant in fruit.

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Vernacular.—Jaugli-chichonda, Palwal (*Hind.*), Patol, Bon-patol (*Beng.*), Rán-parval, Karu-parval (*Mar.*), Parwar (*Guz.*), Kattup-pepudal (*Tam.*), Chyad-potta (*Tel.*), Gwal-kakri (*Punj.*), Dummaala (*Cingh.*), Padavalam (*Mal.*).

History, Uses, &c.—In Northern India, Bengal and Guzerat the fruit of *T. dioica* is considered to be the Patola of Sanskrit writers, and in Western and Southern India, where *T. dioica* is not found, *T. cucumerina* is used as Patola. Patola or Patolaka, "shaped like a muscle shell," is a medicine in great repute amongst the Hindus as a febrifuge and laxative in bilious fevers, the decoction of the whole plant being administered in combination with other bitters. It is also considered to purify the blood and remove boils and skin eruptions; aromatics may be added to the decoction. The following prescription from Chakradatta may be taken as an example:—Take of Patola, Tinospora, Cyperus, Chiretta, Neem-bark, Catechu, Oldenlandia, Root bark of Adhatoda, equal parts, in all two tolas (360 grains), and prepare a decoction which is afterwards to be boiled down to one-fourth, and taken in divided doses during 24 hours. The drug is also administered in combination with Turbith as a drastic purgative in jaundice and dropsy; the *Patoladya churna* is a compound purgative powder of this kind. Both of these plants are found in a wild and in a cultivated condition; for medicinal purposes, the wild plants are used, the cultivated fruits, though still bitter, are favourite vegetables with the Hindus and exert a mild aperient action when freely eaten.

Mahometan writers describe the plant as cardiacal, tonic, alterative and antifebrile, and say that it is a useful medicine for boils and intestinal worms. The author of the Makhzan remarks that the Hindus in obstinate cases of fever infuse 180 grains of the plant with an equal quantity of Coriander for a night, and in the morning add honey to it and strain the liquor; this quantity makes two doses, one of which is taken in the morning and one at night. In the Concan the leaf juice is rubbed over the liver or even the whole body in remittent fevers. In Guzerat the fruit of the cultivated *T. dioica* is

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steamed, stuffed with spices, fried in melted butter, and eaten with wheaten bread as a remedy for spermatorrhœa. Ainslie, under the name of *T. laciniosa,* notices the use of *T. cucumerina* as a stomachic and laxative medicine among the Tamools, and says it is the Patola of Southern India. Rheede gives the following account of its medicinal properties:—"Decoctum cum saccharo sumptum, digestioni confert, tormina intestinorum, ac alios ventris dolores sedat, phlegmata expectorat, pectoris angustiam tollit; febres minuit, humores attemperat, vermes enecat. Succus expressus idem præstat et vomitum provocat. Radicis succus ad quantitatem duarum unciarum epotus, valde purgativus est, in ipsa accessione februm quotidianarum ac quartanarum ex pituita provenientium, frigus vel diminuit vel in totum tollit, per vomitum scilicet: stipes in decocto datus phlegmati expectorando conducit: fructus quaquo modo sumpti tumores expellunt."

From our observation of the action of these plants we cannot find that they differ in any way from colocynth; like that drug they require to be combined with aromatics to prevent griping. Their febrifuge action appears to depend upon their purgative properties.

Description.—*T. dioica*—Stems twining, more or less woolly and scabrous. Leaves 3 by 2 in., harsh, sinuate-dentate, not lobed; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs. Calyx-tube 1¾ in., narrow. Fruit 2 to 3½ in., oblong, acute, orange-red. Seeds ⅜ to ½ in., half-ellipsoid, compressed, corrugate on the margin. Plant diœcious.

T. cucumerina—Stems twining, more or less pubescent. Leaves 2 to 4 in., usually 5-lobed about half-way down, lobes obtuse, or if acute not acuminate; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs, often racemed. Calyx-tube 1 inch. Fruit 1 to 4 in., oblong, acute, red. Seeds ¾ to ½ in., half-ellipsoid, compressed, corrugate. Plant diœcious. (*Fl. Br. Ind.*)

MOMORDICA DIOICA, *Roxb.*

Fig.—*Wight Ic., tt.* 505, 506; *Rheede, Hort. Mal. viii.,* 12.

Hab.—Throughout India The tubers.

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Vernacular.—Kirara, Dhár-karela (*Hind.*), Karantoli (*Mar.*), Palupaghel-kalung (*Tam.*), Agokara, Angakara (*Tel.*), Erimapavel (*Mal.*), Madahagala (*Can.*).

Uses, Description, &c.—The muricated fruit of this plant is called Váhasa by Sanskrit writers, that of the wild plant is extremely bitter, but under cultivation it loses much of its bitterness and is commonly used as a vegetable. The fruits burst irregularly when ripe showing the red arillus of the seeds, which are black, shining, and almost spherical. The plants are male and female, and have rather large yellow blossoms. The tubers of the female plant are the largest, and are used medicinally. Rheede says that the plant is truly cephalic, for mixed with cocoanut, pepper, red sandal, and other ingredients, and applied in the form of liniment, it stops all pains in the head. Ainslie notices the use of the root by Hindu doctors in the form of electuary in cases of bleeding piles, and in certain bowel affections connected with such complaints, the dose being about 2 drachms or more twice daily. In the Concan the juice of the root is a domestic remedy for the inflammation caused by the contact with the urine of the House-lizard. The roots, which often weigh a pound or more, much resemble a turnip, but are more elongated; they are of a yellowish-white colour, and marked externally with whitish, raised circular rings; the taste is astringent.

Chemical composition.—The air-dried roots lost 72·78 per cent. when heated to 100° C., and afforded 3·42 per cent. of ash. The ash contained a slight trace of manganese.

The coarsely-powdered roots were exhausted with 80 per cent. alcohol; from the resulting tincture most of the alcohol was distilled off, and the remainder allowed to evaporate by exposure to the air. During evaporation a deep yellow oily looking matter separated, and the liquid gelatinized. The alcoholic extract was somewhat bitter, and left an unpleasant metallic taste in the mouth. By the addition of water the extract was converted into a turbid orange yellow mixture, which was agitated with petroleum ether.

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The petroleum ether extract was of a light yellow colour, soft, non-crystalline, and possessed a fragrant odour similar to that of methyl salicylate. In ether it was wholly soluble; and with the exception of a few white flocks it was also soluble in absolute alcohol, with acid reaction. In cold aqueous caustic soda it was insoluble, but when gently warmed a portion dissolved, and the liquid assumed a deep orange colour; the addition of an acid to the alkaline solution caused a milkiness: during digestion with the caustic soda solution a very fragrant odour was noticed. The agitation of an ethereal solution of the petroleum ether extract with dilute hydrochloric acid, afforded traces of an alkaloid.

The aqueous residue after treatment with petroleum spirit was agitated with ether. The ethereal extract was yellowish, soft, indistinctly crystalline, and had an odour similar to that noted in the petroleum ether extract. In water the extract was partly soluble with strongly acid reaction, and the solution gave marked indications of the presence of an alkaloid; with ferric chloride the solution gave a dirty violet-reddish coloration. The residue insoluble in water was yellowish, and partly soluble in ammonia with yellow coloration: the insoluble residue was whitish. The addition of acids to the ammoniacal solution caused the precipitation of white flocks.

The original aqueous solution after separation of ether was rendered alkaline with carbonate of soda and agitated with ether; the ethereal extract amounted only to a trace, but afforded indications of an alkaloid with the usual reagents: no special colour reactions were noted.

After separation of ether, the aqueous alkaline residue was acidified with acetic acid and agitated with acetic ether: the extract thus obtained was reddish, and partly gelatinized on evaporation: it was partly soluble in acetic acid, a turbidity being produced by dilution with water.

In order to ascertain whether a purgative principle was present or not, an alcoholic extract from 10 grams of the root was rubbed up with water and injected into a cat's stomach, no purgative action was produced, and with the exception of an

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attack of vomiting one hour and ten minutes after administration of the drug, no symptoms appeared to be induced.

MOMORDICA COCHINCHINENSIS, *Spreng.*

Fig.—*Bot. Mag., t.* 5145.

Hab.—Bengal to Tenasserim, Deccan Peninsula, Canara. The seeds.

Vernacular.—Kakrol (*Hind., Beng.*).

History, Uses, &c.—The seeds after the shells have been removed are fried and eaten either alone or with other food. (*Makhzan.*) They are considered to be good for cough and pains in the chest. Powdered they form one of the ingredients of the hot stuff known as *Jhál* in Bengal, which, mixed with melted butter, is given to women immediately after parturition, and daily for a few days afterwards. *Jhál* is believed to act as a stimulant, destroying the excess of phlegmatic humours which are supposed to be produced in the body after delivery. (*C. L. Bose.*) A plaster made with the roots is said to promote the growth of the hair, and prevent its falling off. The plant is called in Sanskrit Karkataka, from the resemblance of the seeds to the shell of a crab. This plant is the *Muricia cochinchinensis* of Loureiro, who says that the berries are used for colouring food, and that the seeds and leaves are aperient and abstergent and useful in hepatic and splenic obstructions, in unhealthy ulcerations, lumbago; and externally in *procidentia uteri et ani,* fractures and luxations of the bones.

Description.—The seeds are $\frac{7}{8}$ by $\frac{5}{8}$ of an inch in diameter, and $\frac{1}{4}$ of an inch thick, ovate, compressed, black; corrugated on the margins and sculptured on the faces. The shell is fragile, and encloses an oily kernel.

Chemical composition.—Kakrol seeds deprived of their husks yielded 43·74 per cent. of a slightly greenish oil when treated with light petroleum ether. The oil possessed very powerful siccative properties; smeared in a thin layer on a glass plate,

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and exposed to a temperature of 100° C., in the course of an hour the oil assumed a translucent white appearance, and could be scraped off the glass as a white powder which, when boiled with petroleum ether, yielded only a trace of soluble matter, consisting of oil. Exposed to the air without being heated, in 24 hours a thin layer presented numberless little white cauliflower like masses, while a portion of the oil assumed an arborescent pattern on the glass. After saponification of the oil, and decomposition of the soap, the separated fatty acids had a melting point of 48°—49° C.

In addition to oil, a very slightly bitter glucoside was present, which afforded no special colour reactions with reagents.

MOMORDICA CHARANTIA, *Linn.*

Fig.—*Bot. Mag., t.* 2455; *Wight Ic., t.* 504; *Bot. Reg., t.* 980.

Hab.—Throughout India. The fruit.

Vernacular.—Karela (*Hind.*), Kárala (*Mar.*), Pava-kai, Pávakkapchedi (*Tam.*), Kákara-chettu (*Tel.*), Karala (*Beng.*). Muricated var., Uchchhe (*Beng.*), Hagala (*Can.*).

Description, Uses, &c.—There are two chief varieties differing in the form of the fruit, the one being longer and more oblong, and the other smaller, more ovate, muricated and tubercled. There are besides many intermediate gradations. The fruit is bitter but wholesome, and is eaten by the natives. It requires, however, to be steeped in salt water before being cooked; the smaller variety is most esteemed. (*Drury.*) From Rheede, Wight and Gibson we learn that the Hindus use the whole plant combined with cinnamon, long pepper, rice and the oil of *Hydnocarpus Wightiana*, as an external application in scabies and other cutaneous diseases. The fruit and leaves are administered as an anthelmintic, and are applied externally in leprosy. One-eighth of a seer of the juice of the leaves is given in bilious affections, as an emetic and purgative, alone or combined with aromatics; the juice is rubbed in, in

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burning of the soles of the feet, and with black pepper is rubbed round the orbit as a cure for night blindness. The Sanskrit name is Káravella, the muricated variety is called Sushavi, and bears the synonym Kándira or "armed with arrows." The author of the *Makhzan-el-Adwiya* describes the fruit as tonic and stomachic, and says that it is useful in rheumatism and gout, and in diseases of the spleen and liver; he also mentions its anthelmintic properties. He points out that some have erroneously supposed it to be identical with the Katha-el-himár of the Arabs, which is a violent purgative. Drury has the following description of *M. Charantia*:—"Climbing, stem more or less hairy; leaves palmately 5-lobed, sinuate, toothed, when young more or less villous on the underside, particularly on the nerves; peduncles slender, with a reniform bracteole about the middle, female with it near the base; fruit oblong or ovate, more or less tubercled or muricated; seeds with a thick notched margin and red aril; flowers middle-sized, pale yellow." In the rainy season the plant may be seen in almost every garden in India. The fruit is also offered for sale in the market, and when well cultivated attains the size of a cucumber.

MOMORDICA CYMBALARIA, *Fenzl.*

Fig.—Lyon *Med. Jurisp. for India, p.* 200, *f.* 14.

Hab.—Deccan Peninsula, Mysore, Concan. The tubers.

Vernacular.—Kadavanchi (*Mar.*).

History, Uses, &c.—The whole plant is acrid; it is mentioned here as a number of the tubers were forwarded to the Chemical Analyser to Government, Bombay, from Satara, as having been found in the possession of a person suspected of administering drugs to procure abortion. Our specimen was grown from one of these tubers. Dr. Lyon, the Chemical Analyser, informs us that on reference to the records of his office he finds that the Kadavanchi tubers have been three times sent to him within the last four years as having been used to procure abortion. In 1889, the tubers were again

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forwarded to Dr. Barry, Acting Chemical Analyser, in connection with a case of abortion.

Description.—Root tuberous, ovoid; the tubers had the odour of cucumbers, and examined under the microscope, the central portion was seen to consist of starch cells, between this portion and the epidermal layer irregular masses of a resinous substance were observed; leaves 1—2 inch broad, 5-angular or slightly 5-lobed, middle lobe not elongated, glabrous or slightly pubescent, often punctulate on both surfaces, dentate: petiole ½—1½ in. Male raceme 1—2 in., with usually only two to four flowers; calyx-lobes lanceolate; petals ¼ in., white; filaments two, one 2-fid, one 3-fid, so each with one anther-cell; filaments inserted near the top of the calyx tube, anthers completely exsert. Female peduncle ¾—2 in., one flowered, ebracteate (the male peduncle has a minute bract). Fruit ¾—1 by ¼ in. Seeds ⅙—¼ in., few, shortly obovoid, smooth, shining. (*Fl. of Brit. India.*) The fruit has eight prominent ribs, and is covered with silky hairs; while still green, it dehisces into four parts, and discharges its seeds, which are obovoid, dark brown, slightly warty, as large as a small peppercorn, and with a prominent hilum.

Chemical composition.—A bitter glucoside was isolated from the portion of the alcoholic extract of the tubers soluble in water. It was almost insoluble in ether, and was precipitable from its aqueous solution by tannin and alkaloidal reagents. With strong sulphuric acid it turned bright red and the colour gradually changed to purple, which remained for several hours.

A yellow acid resin of very acrid properties was present in the tincture, together with a saccharine principle.

A tuber weighing 2 grams was incinerated, the ash amounted to 6 per cent.

LUFFA ACUTANGULA, *Roxb. Var. amara.*

Fig.—*Bot. Mag.* 1638.

Hab.—Throughout India. The fruit and vine.

Vernacular.—Karela-toria, Karvi-turai (*Hind.*), Kadu-sirola, Kadu-dorka (*Mar.*), Ghosha-lata, Tito-torai (*Beng.*), Pé-pirkkam

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(*Tam.*), Chedu-bira, Verri-bira (*Tel.*), Kadvi-ghisodi (*Guz.*), Hire-balli (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Koshataki, a general name for the genus Luffa, from *kosha*, the cocoon of a silk-worm, and in allusion to the way in which the seeds are enclosed within a fibrous network. The names Dalika and Ghoshaka appear more particularly to appertain to this species. The Hindus apply the juice of the immature gourd, which has been slightly roasted, to the temples to cure headache, and administer an infusion of the ripe fruit as a vomit and purge. Roxburgh notices the cathartic and emetic properties of the fruit. In the *Pharmacopœia of India* the plant is described as a bitter tonic and diuretic, and is recommended in enlargements of the spleen on the authority of Dr. J. A. Green and Mr. J. C. Dickenson. The juice of the leaves is used as an external application to sores, and the bites of venomous animals, and the pulp of the fruit is administered internally in the latter class of cases to cause vomiting and purging, just as colocynth is used where that plant is abundant. The dried fruit is powdered and made into a snuff for those suffering from jaundice, and the root with equal parts of *Hibiscus Rosa-sinensis* root and *Hemidesmus* is given with milk, cumin and sugar in gonorrhœa.

Description.—The vine of *L. amara* resembles that of the cultivated plant. The fruit is smooth, from 3 to 5 inches long, ovoid, marked with ten prominent, sharp longitudinal ridges; at the apex is a small operculum rather more than half an inch in diameter, which is deciduous. Internally it is filled with white spongy pulp, of a cucumber odour. The seeds are grey and marked with small irregular black prominent specks. The leaves are bitter, the fruit less so.

LUFFA ECHINATA, *Roxb.*

Fig.—*Lyon, Med. Juris. for India, p.* 201.

Hab.—Guzerat, Sind, Bengal, Dacca. The fruit.

Vernacular.—Kukar-lata, Bindál, Ghagar-bel, Deodáil (*Hind.*), Kukar-vel, Vápala (*Guz.*), Deodangri, Deotádi (*Mar.*), Deodáli (*Can.*).

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History, Uses, &c.—This plant is used medicinally in most parts of India. In the Nighantas it bears the following Sanskrit names: Devadáli, Vrata-kosha, Devatádi, Gará, Jimúta, Taraki, Veni, Jálani, and Akhu-visha-ha; it is described as expelling bile, phlegm, and removing piles, swellings, jaundice, phthisis, hiccough, worms and fever, and acting as an emetic.

In Guzerat the fruit is well known as Vápala-bij, a name derived from the Sanskrit *vápa*, "weaving," in allusion to the cocoon-like network in which the seeds are enclosed. The drug is a frequent ingredient in the compound decoctions which are prescribed for bilious fevers. In the Concan a few grains of the bitter fibrous contents of the fruit are given in infusion for snake-bite and in cholera after each stool; in putrid fevers the infusion is applied to the whole body, and in jaundice it is applied to the head and also given internally; the infusion has also a reputation as a remedy for colic. We have not met with any notice of the medicinal use of this plant in European works on the Materia Medica of India.

Description.—The stems are herbaceous, scandent, five-sided, slightly hairy; tendrils two cleft; leaves generally five-lobed, somewhat hairy, margins scallop-toothed; petioles as long as the leaves, ribbed; fruit oval, the size of a nutmeg, armed with numerous long, rather soft, diverging bristles, obscurely divided into three cells by a network of dry fibres, and opening at the top with a perforated stopple, which falls off when the seeds are ripe; seeds about 18, ovate, compressed, black and scabrous; testa very hard; kernel white. The fibrous substance in which the seeds are enclosed is intensely bitter.

Chemical composition.—The air-dried fruit deprived of seeds as much as possible was agitated with 80 per cent. alcohol: the greater part of the spirit removed by distillation, and the remainder allowed to evaporate by exposure to air. During spontaneous evaporation the tincture gelatinized. When the extract no longer smelt of alcohol it was gently warmed on the water bath, water added, and when cold the turbid mixture

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repeatedly agitated with ether. The ether was much coloured; gelatinous flocks separated during agitation.

The ethereal solution contained a large amount of chlorophyll, and after evaporation of the ether, the residue became partly crystalline. The extract was repeatedly treated with light petroleum ether, which removed some waxy and much colouring matter, and a crystalline principle, appearing as needles and stellate masses under the microscope, which was not further examined. The dark residue insoluble in petroleum ether was then boiled with water; the aqueous solution was slightly yellow, became turbid on cooling, and possessed an extremely bitter taste. This aqueous solution was agitated with ether; on spontaneous evaporation a yellow transparent varnish was left, destitute of any crystalline structure. The extract treated with water afforded a white curdy precipitate with tannic acid: no precipitate with Mayer's reagent: with ferric chloride it afforded a slight greenish coloration; after boiling with dilute sulphuric acid, the solution readily reduced Fehling's solution. This principle would appear to be allied to, if not identical with, *colocynthitin*.

Its physiological action was tried in the following experiment:—0·0296 gram. was dissolved in a few drops of alcohol and warm water, and injected into a full grown, fasting cat's stomach at 10-50 a. m.

11-20 a. m.—Vomited several times, first contents of the stomach, and then white frothy mucus, not tinged with blood.

12-0 noon.—Passed a solid stool: lying on its side breathing slow.

1-40 p. m.—Passed a semi-solid stool tinged with blood; pupils somewhat dilated; now and again contraction of abdominal muscles: uneasy, chiefly on its side, but shifts its position frequently.

2-45 p. m.—Pupils widely dilated: less of power in hind legs, unable to stand: appears to have some difficulty in raising its head; which it keeps between its fore paws, which are extended; expression anxious.

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2-55 p. m.—Slight convulsive movements of hind legs; breathing very shallow; pupils widely dilated; position as before.

2-57 p. m.—Marked convulsive movements of hind legs; breathing spasmodic and loud.

3-4 p. m.—Spasmodic gasps at intervals of about 10 seconds.

3-15 p. m.—Died; no further convulsive movements.

Death thus resulted in 4 hours 25 minutes after introduction of the drug into the stomach, and only one stool was passed which could be ascribed as being due to its action.

Post-mortem examination 20 minutes after death:—Both lungs pale and collapsed; no fluid in pleural cavity.

Heart contracted, and empty; no clots.

Stomach contained frothy glairy mucus, and a deep yellow fluid, walls darkly congested; no effusion of blood.

Liver congested. Spleen normal. Kidneys, central portions lightly congested.

Intestines—Rectum highly congested, with bloody adherent mucus; the lower portion of the jejunum comparatively slightly congested in patches, the upper portion more deeply congested, until the duodenum is reached, when the whole of the gut was of a dark claret colour, from uniform congestion. The ilium was wholly free from congestion and was bile stained.

The gelatinous flocks which separated on agitating the aqueous alcoholic extract with ether had the following properties:—By boiling with water an opalescent solution was obtained, which was filtered. The insoluble residue on the filter was soluble in boiling absolute alcohol, on concentration microscopic needles, rods, and plates separated. This residue was not further examined; it did not exceed a trace. The aqueous filtrate gelatinized before it was quite cold. A portion was evaporated to dryness and boiled with absolute alcohol, when with the exception of a trace of insoluble matter, it wholly dissolved, forming a yellowish and bitter solution. On spontaneous evaporation opalescent masses separated on the sides of the beaker, and the solution formed a jelly. On completely evapo-

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rating off the alcohol, brittle yellowish flakes were left. In ammonia the principle dissolved forming a deep yellow solution; on the addition of acids the colour was discharged, slightly yellowish flocks being precipitated, which redissolved in alkalies with a deep yellow coloration: with tannin no precipitate was produced. Fröhde's reagent gave a yellow colour in the cold, becoming emerald green on heating, and changing on cooling to blue, green, and finally to yellow. Nitric acid gave a yellow colour. Mayer's reagent, after acidulation with sulphuric acid, gave no precipitate. Concentrated sulphuric acid gave a deep yellow : on the addition of bichromate of potash there was no special colour reaction. On boiling with dilute sulphuric acid, yellow flocks separated, only slightly soluble in boiling water, and not gelatinizing; slightly soluble in ether; dissolving in alkalies with a deep yellow coloration and reprecipitated in gelatinous flocks by acids. The aqueous acid filtrate after digestion with Barium carbonate was slightly bitter, and precipitated an alkaline copper solution on boiling.

The gelatinizing properties of this principle appear to be very marked. ·1016 gram when dissolved in 100 c. c. of boiling water, gelatinized when the temperature fell to 35° C., so that the beaker containing the solution could be inverted. We have provisionally termed this principle "*luffein*," and we think it not unlikely that it will be found in the fruit of most other plants of the same and allied orders; it differs from pectin, vegetable mucilage, &c., by being soluble in alcohol. From the original aqueous solution after dissolved ether had been expelled, agitation with acetic ether yielded an extractive, highly bitter, which afforded reactions similar to those of colocynthin.

We were unable to obtain the principle in a crystalline form.

The seeds contain a bland fluid oil free from bitterness, and which possesses some siccative properties.

Toxicology.—Dr. Burton Brown (*Punjab Poisons*, p. 206,) notices the use of the fruit as an abortifacient. In 1887, Dr.

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Kirtikar recorded (*Trans. Bomb. Med. and Phys. Soc.*) a case of poisoning with symptons resembling those of cholera, after the administration of one fruit as a purgative; this dose proved fatal. The drug must therefore be used with great caution.

CEPHALANDRA INDICA, *Naud.*

Fig.—*Wight Ill., t.* 105; *Hook. Ic. Pl. I., t.* 138.

Hab.—Throughout India.

Vernacular.—Kunduri (*Hind.*), Telakucha (*Beng.*), Kovai (*Tam.*), Rán-tondla (*Mar.*), Gholi (*Guz.*), Tonde-konde (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Vimba, Vimbaja, Tundkéri and Tundika; it has a scarlet fruit, and Indian beauties are descriped as Vimboshta, "red or cherry-lipped," by poets and story tellers. The root and juice of the leaves is used medicinally; the wild fruit is very bitter, but that of the cultivated form is sweet and is much used as a vegetable. In Hindu medicine the juice of the tuberous root is used as an adjunct to the metallic preparations prescribed in diabetes in doses of one tola (180 grs.) every morning. Dutt states that he has known several patients who were benefited by its use. Ainslie notices its use in southern India, and says that the juice of the leaves is applied to the bites of animals, Moodeen Sheriff states that in the bazars of the south the root is sold as a substitute for Caper root. In the Concan the root pounded with the juice of the leaves is applied to the whole body to induce perspiration in fever, and the green fruit is chewed to cure sores on the tongue. We have found the deep green leaves useful as a colouring agent in preparing Savine ointment from the essential oil.

Description.—Fruit bitter, fleshy, cylindrical, smooth, green, with ten white stripes when unripe, in which state it is used when cultivated and free from bitterness; when ripe scarlet, indehiscent, about 2 inches long by one in diameter; seeds numerous. The natural form of the root is a long tapering tuber, but it is often much deformed when growing in

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stony ground and becomes crooked and knotty. It is perennial and often attains a considerable size, but the average diameter in the wild plant is from 1 to 2 inches at the thickest part a little below the crown. Externally the root is of a pale yellowish-brown colour, with indistinct circular constrictions and longitudinal furrows. The transverse section is yellow with distinct medullary rays. The root is traversed by numerous bundles of stout woody fibres; when wounded a clear juice exudes having a cucumber odour, which dries into an opalescent gum. The root has an acid and astringent taste, and is not quite free from bitterness.

Chemical composition.—The sliced tubers were dried at a low temperature, reduced to powder, and the powder sifted from woody fibre. Dried at 100° C. the powder lost 6·76 per cent. of moisture. The ash amounted to 15·52 per cent., there was nothing special to note regarding its composition; it did not contain any manganese. The powdered tubers were exhausted with 80 per cent. alcohol; the tincture was of a yellow colour: on concentration resin and oily particles separated; the addition of water caused a turbidity; the turbid solution was heated to drive off the last traces of alcohol: the liquid had a strongly acid reaction. To the turbid acid solution more water was added and the liquid agitated with ether. The separated ether was agitated with dilute hydrochloric acid; the acid solution gave indications of the presence of an alkaloid. The separated ether left on evaporation a soft yellowish non-crystalline residue, possessing a fragrant odour. This extract was insoluble in alkalies, easily soluble in alcohol, ether and benzol. The aqueous solution after separation of ether was rendered alkaline with carbonate of soda, and agitated with ether. The hydrochloric acid solution referred to above was treated in a similar manner, and the separated ethers mixed. The mixed ethereal solution left on spontaneous evaporation a soft yellow non-crystalline residue, possessing a fruity odour, which was considerably increased by the addition of dilute sulphuric acid. In dilute acids the extract was partly soluble; the acid solution gave a precipitate with all alkaloidal

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reagents. The special properties of this alkaloid will be considered later. The principle insoluble in acids had the properties of a resin.

The alkaline aqueous solution was subsequently agitated with chloroform, and then with amylic alcohol. In both cases extracts were yielded partly soluble in dilute acids, the solutions affording precipitates with alkaloidal reagents. From colour reactions and the physical properties of these alkaloids, they appeared to be similar to the one first extracted by ether. The three acid solutions were consequently mixed, agitated with amylic alcohol, which removed a trace of resin; the acid then neutralized with carbonate of soda, and the solution agitated with fresh amylic alcohol. On evaporating off the amylic alcohol, a varnish-like residue was left, easily soluble in alcohol and amylic alcohol, but less readily dissolved by ether chloroform. In water the extract was only very slightly soluble; in dilute sulphuric acid it was not wholly soluble, a trace of resin being left. The acid solution was strongly bitter. With alkaline carbonates it gave a white precipitate; with platinic and auric chlorides amorphous precipitates: it also yielded precipitates with phosphomolybdic acid, potassio-mercuric iodide, teriodide of potassium, picric acid, &c. With concentrated nitric acid it afforded no colour reaction in the cold, but on the application of a gentle heat a slight yellow colour was developed: concentrated hydrochloric acid gave no reaction in the cold or on heating; concentrated sulphuric acid gave a light brown tint in the cold, which became reddish-brown on heating. Fröhde's reagent gave a lilac tint in the cold, which became reddish on heating, and blue as the liquid cooled. Bichromate of potassium and sulphuric acid afforded no special colour reaction; ferric chloride gave no colour reaction. This alkaloid was only present in very small amount, hardly more than a marked trace.

Ether chloroform and amylic alcohol also extracted a golden brown resin, insoluble in alkaline carbonates, easily soluble in caustic soda, and less readily dissolved by ammonia. In amylic alcohol the resin was more easily soluble than in ether or

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chloroform. From its alkaline solutions it was precipitated by dilute acids in yellowish flocks.

After agitation with amylic alcohol the alkaline solution was precipitated with plumbic acetate; on decomposing the lead salt with hydro-sulphuric acid an organic acid was obtained, which afforded the reactions of citric acid. The liquid after separation of the lead precipitate was treated with hydro-sulphuric acid, the filtrate evaporated to a syrup, and heated for some hours on the water bath, on diluting with water a strongly acid solution was obtained, the acidity of which was not due to acetic acid; the nature of this organic acid was not determined.

A principle which easily reduced an alkaline cupric solution was also present in the liquid.

The tubers contained starch; they did not afford any tannic matter.

ZEHNERIA UMBELLATA, *Thwaites.*

Fig.—*Rheede Hort. Mal. viii., t.* 26.

Hab.—Throughout India. The fruit and roots.

Vernacular.—Tarali (*Hind.*), Kudari (*Beng.*), Gometta (*Mar.*), Tid-dánda (*Tel.*), Karivi-valli (*Mal.*).

History, Uses, &c.—This plant is the Gointhi or Karivi-valli of Rheede, who notices its use by the Hindus of Malabar as a depurative, useful in gonorrhœa, dysuria and diseases supposed to arise from adust bile in the blood. The Portuguese call it *Popinho do Patare* and the Dutch *Karlingen.* Roxburgh describes it under the name of *Momordica umbellata,* and notices the use of the fruit and roots as a medicine by the natives, but does not give any particulars. The root is usually prescribed as a *Paushtika* or invigorating medicine, combined with roasted onions, cumin, sugar and melted butter, forming a *ghritapaka* or medicated butter; sometimes the root is given beaten up with milk and sugar, to which cumin is added if it is prescribed as a remedy for gonorrhœa.

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In the Concan the juice of the leaves is applied to parts which have become inflamed from the application of the juice of the marking nut (*Semicarpus Anacardium*).

Description.—From the *Flora of British India* it will be seen that this is a very variable plant common on hedges throughout India, Ceylon, Malaya, China and North Australia. It is diæcious, and has a root consisting of many pendulous tubers.

The leaves are shortly petioled, cordate or sagittate or hastate at the base, the lobes longer than the petiole, 3 to 5-lobed, or palmately 5-partite, sinuate and sharply toothed; male flowers umbelled or shortly racemose at the apex of a long slender peduncle; female on a different plant, solitary, short-peduncled; berry oval or oblong, size of a pigeon's egg, smooth, red when ripe. The tubers are of an irregular, elongated form, usually about one inch in diameter; brown externally, white internally; they have a faint nauseous taste.

CORALLOCARPUS EPIGÆA, *Hook. f.*

Fig.—*Wight Ic., t.* 503.

Hab.—Punjab, Sind. Guzerat, Deccan. The tubers.

Vernacular.—Akás-gadda, Chhilihinda, Garaj-phal (*Hind.*), Karvi-nai (*Guz.*), Akásha-garudan, Gollan-kovaik-kizhangu (*Tam.*), Akásha-garuda-gaddalu, Nága-donda (*Tel.*), Akasha-garuda-gadde (*Can.*), Siva-linga (*Mar.*).

History, Uses, &c.—This plant is called in Sanskrit Chhilihinda, Pátála-garuda and Maha-mula or "great-root." It is described in the Nighantas as very strengthening, and a begetter of phlegmatic humors, and a valuable remedy for rheumatism. Ainslie remarks that the Vytians hold it in great estimation, and prescribe it in the latter stages of dysentery, and old venereal complaints. It is usually administered

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in powder, the dose being about one drachm in the 24 hours, and continued for eight or ten days together; this quantity generally produces one or two loose motions every day. It is also considered anthelmintic. For external use in chronic rheumatism it is made into a liniment with cumin seed, onions, and castor oil. In the Deccan and Mysore the root has a repute as a remedy for snake-bite; it is administered internally and applied to the bitten part. This plant is used in India as a substitute for the Lúf or Lúfa of the Arabian and Persian physicians, the *Bryonia dioica* of more Western countries, and the ἄμπελος λευκη of Dioscorides. The Arabic word *Lúfa* is probably a corruption of λευκη.

The vernacular names are mostly compounds of Ákás, "the sky," and Gadda, "a tuberous root." The Marathi name signifies "the linga of Siva," and is an allusion to the shape of the fruit.

Description.—The root is a turnip-shaped tuber, sometimes weighing as much as 5 to 6 pounds. Externally it is yellowish white and marked with raised circular rings; the taste is bitter, mucilaginous, and subacid. When cut the tuber exudes a viscid juice, which soon hardens into an opalescent gum.

Chemical composition.—The bitter principle of *C. epigæa* can be removed from an aqueous extract, previously separated from mucilage by treatment with alcohol, by agitation with chloroform or amylic alcohol. It is a whitish amorphous mass soluble in water and spirit, and very slightly soluble in ether. Its solution is precipitated by tannin and not by either basic or neutral plumbic acetate. It is coloured reddish-brown by sulphuric acid, and after several hours assumes a purplish hue owing to the gradual deposition of a black powder. The purple colour is not so well marked as that afforded by *trichosanthin* and the bitter principle of *Momordica Cymbalaria*. It dissolves in nitric acid without colour. This bitter principle is the same as *bryonin*, which has been found by Walz in common

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Bryony root, and we have been able to confirm this by finding in the decomposition products two resinoid bodies differing in their solubility in ether. Bryonin is a glucoside resolved by boiling with dilute sulphuric acid into glucose and two amorphous bodies, bryoretin, soluble in ether, and hydrobryoretin, insoluble in ether but soluble in alcohol

$$\underset{\text{Bryonin}}{C^{48}H^{84}O^{21}} = \underset{\text{Bryoretin}}{C^{21}H^{35}O^{7}} + \underset{\text{Hydrobryoretin}}{C^{21}H^{37}O^{8}} + \underset{\text{Glucose.}}{C^{6}H^{12}O^{6}}.$$

We have been unable to find a second bitter principle in these tubers, for on washing the lead precipitate of the extract until free from bryonin, and treating the lead compound with hydrogen sulphide, the solution was free from bitterness, and the evaporated residue was not coloured by sulphuric acid. The tubers contained much starch, a little resin, and 10 per cent. of white saline ash.

BRYONIA LACINIOSA, *Linn.*

Fig.—*Wight Ic., t.* 500; *Rheede Hort. Mal. viii.,* 19.

Hab.—From the Himalaya to Ceylon, Pegu. The plant.

Vernacular.—Bajguriya, Ghargu-náru (*Hind.*), Kavadori, Kavale-che-dole (*Mar.*), Nehoemeka (*Mal.*), Lingatondi (*Can.*).

History, Uses, &c.—This plant appears to be the Baja of Sanskrit writers, and is said to have been used in Vedic times to frighten away evil spirits; it is still known in Hindi as Bajguriya or "Baja beads." It is also probably one of the plants included by the name Ghantáli (see *Mukia scabrella*). Rheede (viii. 19) calls it Nehoemeka, and says that the Portuguese call it *Nhola*, and the Dutch *Slitten.* The vernacular name *Ghargu-náru* signifies a string of ankle bells, such as are worn by dancing girls. These bells have vertical slits in them, resembling the white vertical lines on the fruit of this Bryony. The juice of *B. laciniosa* is given with milk, honey, or sugar in bilious attacks, and in the commencement of fevers when there is flatulence and constipation; it clears

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out the bowels, and is often sufficient without further treatment in cases of this kind which arise from over eating.

Description.—A climbing plant with a smooth stem common in hedges. The leaves are palmately 5-lobed, more or less deeply divided, segments oblong, lanceolate acuminated, serrated; petioles muricated, upper surface of the leaf thickly studded with white, jointed, calcareous hairs, rising from a calcareous areola; male and female flowers, in the same axils, the peduncles of the male flowers, which are numerous, remaining until the fruit ripens; flowers small, pale yellow; fruit round, smooth, marked with white vertical stripes, the size of a marble, red when ripe, with the exception of the stripes, which remain of a dead white. The whole plant is very bitter.

Chemical composition.—An alcoholic extract of the plant was made with 84 per cent. alcohol, water added, and the turbid mixture agitated with light petroleum ether, which removed colouring matter and a small amount of fat.

After separation of the petroleum ether the bright yellow aqueous solution was agitated with chloroform. The chloroform extract was yellowish, non-crystalline and very bitter. Treated with warm water the greater part dissolved, the aqueous solution on evaporation left a residue which gave a white precipitate with tannic acid, and which reduced an alkaline copper solution after boiling with dilute sulphuric acid. Generally the reactions afforded by this bitter principle were similar to those described as being produced by bryonin. With concentrated sulphuric acid a brownish red coloration was produced; whereas in Watts' *Dictionary of Chemistry*, 1st Edition, sulphuric acid is stated to dissolve bryonin "forming a blue liquid which changes to green." Gmelin, however, (*Handbook of Chemistry*) states that it is coloured red brown by oil of vitriol. We have tested the action of concentrated sulphuric acid on a specimen of bryonin obtained from Dr. Schuchardt, and find that no such reaction as is described in Watts' *Dictionary* occurs, the colour tint being brownish red.

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MUKIA SCABRELLA, *Arn.*

Fig.—*Wight Ic., t.* 501; *Rheede Hort. Mal. viii.,* 13.

Hab.—Throughout India. The plant in fruit.

Vernacular.—Agamaki (*Hind.*), Mosumúski (*Tam.*), Putenbudinga, Nádhosa (*Tel.*), Chiráti (*Mar.*), Mucca-piri (*Mal.*).

History, Uses, &c.—Ainslie gives *Ahilaykum* as the Sanskrit name of this plant in Southern India. This is evidently a corruption of अहिलेखन (Ahilékhana), "marked like a snake," in allusion to the vertical white stripes upon the fruit. Another Sanskrit name which appears to have been applied to this plant as well as to *Bryonia laciniosa* is Ghantáli, which signifies a row or string of bells (Ghantá-áli), such as are worn by dancing girls, and which have vertical slits resembling the vertical marks on the fruit of these plants. Ainslie informs us that this herb is considered to be gently aperient and stomachic, the infusion being given in doses of half a cupful twice daily. It is used for the same purposes now, and it enters into mixtures frequently given to children. Rheede mentions its use as a diuretic.

Description.—Plant hispid and scabrous; tendrils simple; leaves cordate, lobed or angled; flowers short-peduncled, male numerous, fascicled; female, 1 to 4, small, campanulate, yellow; berry globular, size of a pea, scarlet when ripe, marked with white vertical lines, smooth or sprinkled with a few bristly hairs. Plant and fruit bitter. The fruits ripen in October to December.

ZANONIA INDICA, *Linn.*

Fig.—*Wight Ill., t.* 103; *Lam. Ill., t.* 816; *Rheede Hort. Mal. viii., tt.* 47, 48, 49.

Hab.—Assam, E. Bengal, W. Peninsula, Ceylon.

Vernacular.—Chirpota (*Hind., Mar.*), Penar-valli (*Mal.*).

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History, Uses, &c.—In the Nighantas this plant bears the Sanskrit names of Chirpota, Dirghapatra, Kuntali and Tiktaka; it is described as cold, dry, and aperient, and beneficial in asthma and cough. Rheede (viii., 47, 48, 49,) calls it Penar-valli, which appears to be a corruption of the Sanskrit Pinda-valli; he says that the Dutch call it *Naet-klim* and the Portuguese *Fruita bandoliera*. The latter name is given to the fruit from its resemblance to the leather cases called bandoleers, each containing a charge of powder, of which every musketeer wore twelve, suspended by a shoulder belt. In Malabar a bath made by boiling the leaves in water is used to remove the nervous irritation caused by boils, and an antispasmodic liniment is made by pounding the leaves with milk and butter. In Ceylon the plant is used as a febrifuge.

Description.—Leaves 6 to 8 by 3 to 4 inches, usually acute; petiole one inch; male flowers very small, pedicels ⅛ to ¼ inch; female flowers, including the ovary, ½ inch; ovary early becoming one-celled by the separation of the three fleshy placentas; seeds much compressed, hardly 1-10 inch thick; capsule large, like a candle extinguisher.

ECBALLIUM ELATERIUM, *A. Richard.*

Fig.—*Bentl. and Trim.*, *t.* 115. Squirting Cucumber (*Eng.*), Concombre d'âne (*Fr.*).

Hab.—Europe, Northern Asia. The fruit.

Vernacular.—Khiyár-i-khar, Katha-el-himar (*Pers.*, *Arab.*), Kátri-indráyan (*Ind. Bazars*).

History, Uses, &c.—The fruit occasionally reaches India in a dry state. It is imported from Persia, and has evidently been gathered while immature, as the contents have not been discharged. *E. Elaterium* is reported to grow in abundance about Tiflis and on the banks of the river Kura, and in Georgian popular medicine, under the name of *Kitrana,* it has a good reputation as a remedy in malarial fevers. At a meeting

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of the Caucasian Medical Society in 1885, Dr. Minkevitch referred to the subject, and stated that the paroxysms may be arrested by the use of the drug, but the relief is only temporary, as they return in two or three weeks. Drs. Lisitzeff and Astvaturoff also stated that in Kakhetian popular medicine, *Kitrana* is used as a narcotic, and is believed to be specially serviceable in cases of hydrophobia. (*Pharm. Journ.*, Feb. 27th 1886, *from Med. Record.*) Elaterium does not appear to be known in Hindu medicine, but the Arabs and Persians are well acquainted with it. The former call the fruit Katha-el-himár (asses' cucumber), and the latter Khiyár-i-khar, which has the same meaning, or Khiarzeh (little cucumber). Haji Zein gives Ispheridagrion (*σφαιρίδιον ἀγρίον*) as the Greek name. The author of the *Makhzan-el-Adwiya* describes it, and also the method of preparing elaterium. To prepare this he directs the fruit to be sliced, thrown upon a strainer and pressed, the pulp is then to be twice washed with water, and the deposit, which is thrown down from the water, collected and dried. It is then to be finely powdered and made into lozenges, with an equal weight of gum arabic or calamine, or half its weight of starch.* The Mahometan writers attach considerable importance to elaterium as a purgative of the diseased humours which they suppose to be the cause of a great number of diseases. They also use poultices made with the fruit, leaves, and root of the plant, and direct the juice of the fruit to be snuffed up the nose to purge the brain, and to be dropped into the ears in otitis. It is worthy of remark that the Hindus use their bitter and purgative cucurbitaceous fruits in the same manner. Elaterin injected subcutaneously acts on the nervous system, causing salivation, insensibility, tetanus and dyspnœa; large doses administered by the mouth cause gastro-enteritis and collapse.

Chemical composition.—The active principle, *Elaterin*, $C^{20}H^{28}O^{5}$, is best obtained by exhausting elaterium with chloroform. From this solution a white crystalline deposit of

* Compare with Dioscorides *περί ελατηριου* and Pliny 20, 3.

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elaterin is immediately separated by addition of ether. It should be washed with a little ether and recrystallized from chloroform.

Elaterin forms hexagonal tables, insoluble in water, slightly soluble in ether, very soluble in alcohol. It gives a carmine colour with phenol and $H^2 SO^4$. (*Fresenius' Zeit. f. anal. Chem.* 17, 500 ; 24, 156.)

Several other cucurbitaceous plants are more or less in use medicinally. Among these we may mention **Modecca palmata**, *Lam.* (*Rheede Hort. Mal. viii.*, 20, 23), the juice of which with cocoanut milk is used as a pectoral in Malabar, and the roots as an ingredient in strengthening medicines (Paushtiks).

Trichosanthes nervifolia, *Linn.* (*Rheede Hort. Mal. viii.*, 16, 17,) is used in the same part of the country to drive away evil spirits. According to Ainslie, the root of **Rhynchocarpa fœtida**, *Schrad.*, is prescribed internally in electuary, in cases of piles, and in powder is sometimes ordered as a demulcent in humoral asthma. The root is about the size of a man's finger, light grey, and has a sweet mucilaginous taste. The Tamil name is Appakovay.

The seeds of **Ampelosicyos scandens**, *Thou.*, *Bot. Mag.* 2681, 2751-2, have been introduced into Bombay from Zanzibar as a vermifuge; they are flat and almost circular, about an inch and a half across ; the external envelope resembles delicate basket work, and is very tough and strong ; the kernel yields a quantity of bland oil. The entire fruit is from 2 to 3 feet in length and 8 to 10 inches thick, marked with deep longitudinal furrows, the inside is divided into from three to six cells, and often contains as many as 250 seeds.

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DATISCEÆ.

DATISCA CANNABINA, *Linn.*

Fig.—*Lam. Ill., t.* 823; *Sibth. Fl. Græc., t.* 960.

Hab.—Himalaya from Cashmir to Nepal; Sind. The herb and roots.

Vernacular.—Akalbar (*Hind.*), Bayr-bunja, Bhangjala (*Punj.*).

Uses.—Datisca is bitter and purgative, and is occasionally used in fevers and in gastric and scrofulous complaints. In Khagan the bruised root is applied to the head as a sedative, and Madden states that under the name *of Bujr Bunga* it is used medicinally in Kurnool. (*Stewart, Cleghorn.*) The plant may be administered in doses of from 5 to 15 grains in intermittents.

Description.—Stem 2—6 ft., stout, branching. Lower leaves 1 ft., pinnate; leaflets 7—11, 6 by 1½ in., petioled; upper much smaller and less divided; floral simple, 3 by 1¼ in. Pedicels often carrying linear bracts; anthers oblong, rather large; filaments very short; styles ¼ inch; capsule ⅓ by less than ⅓ inch (*Fl. Br. Ind.*), one-celled, opening at the apex; seeds numerous, striated, with a cup-like covering at the base.

Chemical composition.—The leaves and roots contain a glucoside, *Datiscin*, $C^{21}H^{22}O^{12}$, which may be obtained by exhausting them with alcohol, evaporating to a syrup, and precipitating the resin with water; from the decanted liquid crystals may be obtained, which should be re-dissolved in alcohol and the remaining traces of resin removed by repreciptation with water. Datiscin may then be obtained in colourless silky needles or scales, little soluble in cold water and only sparingly so in warm water and ether. The crystals are neutral and have a bitter taste; they melt at 180° C. (*Braconnot, Ann. de Chim. et. de Phys.* iii., 277; *Stenhouse, Ann. der Chem. u. Pharm.* xcviii., 106,) *quoted in Wurtz, Dict. de Chim*, i., 1134.

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CACTEÆ.

OPUNTIA DILLENII, *Haw.*

Fig.—*Wight Ill.* 114. Prickly pear (*Eng.*).

Hab.—America. Naturalized in India. The fruit.

Vernacular.—Nágphani, Bidar (*Hind.*, *Beng.*), Naga-kali (*Tam.*), Naga-dali (*Tel.*), Chappál-send, Vilayati-nevarung (*Mar.*), Kattali-Papas, Mullugalli (*Can.*).

History, Uses, &c.—This plant is a native of Mexico and Central America, and was introduced into India by the Portuguese, doubtless with the object of feeding the Cochineal insect upon it, but it is uncertain whether they ever carried out their intention. It is called by the Portuguese *Palmatoria d' inferno*, from the resemblance of its flat branches to a *palmatoria*, or flat piece of wood used in their schools to beat children upon the hand. The Hindus have given it the Sanskrit names of Vidara, "tearing asunder," and Vishva-sáraka, "having all essence."

In 1793—97, Drs. Anderson and Barry attempted to introduce the Cochineal insect, but they appear to have been supplied with the Cochinilla sylvestre, or wild Cochineal, which is said to be small and deficient in colouring matter; this insect is still found in India upon *O. Dillenii.* Dr Fontana, in a communication to the *As. Ann. Regist.* in 1799, states that the Cochineal insect thrived best on the *O. Dillenii*, but the insects from Bengal were found to contain only 10 to 16 per cent. of colouring matter, and fetched only Rs 5 per seer, whereas Mexican cochineal at the time was worth Rs. 16 to 20. The cultivation was subsequently abandoned, probably on account of the more profitable cultivation of Indigo.

Dr. Buchanan in 1801 found cochineal being reared in Mysore. The young insects were put upon the cactus hedges immediately after the rainy season. In six months they had increased sufficiently to begin to collect them; a year more elapsed before the whole plants were consumed. After pay-

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ing all expenses, the farmer sold the cochineal for 11 pence a pound. Dr. Buchanan calls the plants Nopals, their Mexican name, but states that it is the cactus "aboriginal of the country"; he also reports that the insect is of the bad kind recently introduced.

Roxburgh, speaking of *Cactus indicus* (*O. Dillenii*), says:—"Upon this plant the Cochineal insects lately brought from America thrive and multiply abundantly." In 1833-45, the culture of cochineal was again attempted by *M.* Sundt and others upon *O. Tuna* with the true Cochineal insect, and this culture appears to have been carried on to a certain extent, as in 1857 silver grain Cochineal from Chittledroog and Oosoor grown upon this plant was shown at the Madras Exhibition.

In 1848, Dr. Dempster successfully dyed woollen cloths with dye extracted from the insect found on the common prickly pear. The quantity of lake obtained by him from the native Cochineal exceeded that obtained from an equal amount of imported Cochineal, and was also of a more brilliant hue. Dr. Dempster laid particular stress on the advantage of cultivating the native insect in preference to importing foreign varieties, and his views were corroborated by Dr. McClelland of the Calcutta Botanic Gardens, who wrote on the subject in 1848. In the same year, Dr. Fleming found numerous villagers near Amritsar engaged in gathering Cochineal insects from the hedges of cactus or prickly pear. The Cochineal was dried and sold to the Amritsar dyers at one rupee a seer. It appears, however, that the growth of wild Cochineal is very irregular, the insects completely destroy the cactus plants wherever they appear, and some time must elapse before the plants can grow again. The quantity of native Cochineal produced in India is not known. Dr. Bidie, reporting on the culture of Cochineal in India in 1882, remarks:—"The efforts made about the beginning of the present century to establish the industry failed, owing to the introduction of an inferior variety of the Cochineal insect. One of the species of cactus on which the insect feeds in Brazil having been introduced with it in 1795 by Capt. Neilson, H. M. 7th Regiment, it has been naturalised, and

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there are various other species here on which the insect will feed." The report concludes with a description of a Mexican Nopalry or cactus garden, which could be easily imitated in many parts of India.

The Indo-Portuguese of the present day, as well as the natives of India, highly esteem the fruits of *O. Dillenii* as a remedy in whooping cough and asthma. From a few experiments we have made with a syrup of the fruit, which is of a splendid purple colour, it appears to increase the secretion of bile when given in teaspoonful doses 3 to 4 times a day, and to control the spasmodic cough and expectoration. In one case of asthma, due to the irritation of pregnancy, after every remedy which could be suggested had failed, it put a stop to the paroxysms which before its administration occurred regularly after sunset; but if the remedy was omitted they at once returned. Eventually a cure was effected. In several cases of whooping cough, a similar effect was produced as long as the syrup was taken daily, and in a case of bronchial catarrh in the chronic stage with copious expectoration, it almost entirely stopped the cough and expectoration within 24 hours. Its action is probably due to the soluble malate of manganese which we have found contained in the fruit. Kobert has shown that the salts of this metal when injected into the blood or subcutaneously, paralyse voluntary movement and reflex action, and stop the heart in diastole; the paralysis of reflex action being due to the destruction of the transverse conduction of the spinal cord, longitudinal conduction remaining intact.

Chemical composition.—The air-dried fruit heated to 100° C. lost 26·21 per cent. in weight. The ash amounted to 9·65 per cent., and was of a very light dirty reddish colour. Chemically the ash was of interest on account of the extremely large amount of manganese present. Boiling water extracted 46·95 per cent. of yellowish extractive, which contained 4·00 per cent. of ash. The solution had an acid reaction, and readily reduced an alkaline cupric solution on boiling. The acidity was due to malic acid, a trace of citric acid was also present.

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The total free acidity of the air-dried fruit calculated as malic acid amounted to ·63 per cent. The saccharine matter calculated as grape sugar amounted to 29·76 per cent. of the air-dried fruit.

An alcoholic extract of the fruit contained a fluid fatty acid in small amount, also some wax, resinous matter, malic acid, colouring matter, sugar, &c., &c. No alkaloidal principle could be detected.

FICOIDEÆ.

TRIANTHEMA MONOGYNA, *Linn.*

Fig.—*Dc. Pl. Grass.* 109; *Wight Ic., t.* 228.

Hab.—Throughout India. The root.

Vernacular.—Násarjanghi, Bishkhapra (*Hind.*), Vishkhápra (*Mar.*), Satudo (*Guz.*), Sharunnay (*Tam.*), Ghalijeroo (*Tel.*), Sabuni (*Beng.*).

History, Uses, &c.—This plant has been given the Sanskrit name of Sveta Punarnava, or white Bœrhaavia, from the resemblance of its foliage when young to that of *Boerhaavia diffusa.* Both plants when in this condition are eaten as vegetables after being well boiled. In common with *T. pentandra* and *T. decandra* its root is known to the natives of India as having cathartic and irritant properties, and is said to be sometimes given to women to procure abortion. Ainslie says: "The root, which is bitter and nauseous, is given in powder in combination with ginger as a cathartic; when fresh it is somewhat sweet." (*Mat. Ind.* ii., 370.) He also notices similar properties in *T. decandra,* and Stewart records that *T. pentandra* is said to be used in the Punjab to procure abortion. In native practise these roots are considered useful in obstructions of the liver, asthma and amenorrhœa. The dose as a purgative is about two drachms of the powdered root to be repeated until the desired effect is produced.

Description.—A diffuse, prostrate, branched, glabrous, fleshy plant, which appears at the commencement of the rainy

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season; leaves $\frac{1}{2}$ to $1\frac{1}{2}$ in., obovate; petiole $\frac{1}{8}$ in.; flowers solitary; calyx-lobes obtuse, cuspidate; stamens 10 to 20; capsule $\frac{1}{8}$ in., scarious below, beak exserted, coriaceous, somewhat mitriform, adnate to the enclosed seed, lower part 3 to 5-seeded. Seeds black, scarcely shining, with concentric, broken, and undulating, raised lines. (*Fl. Br. Ind.*)

Chemical composition.—The plant affords a thick mucilaginous decoction unaffected by iodine solution, and precipitated by ferric chloride and neutral acetate of lead. It gives a precipitate with barium hydrate, which contains a glucoside having similar properties to saponin; the insoluble decomposition product when weighed pointed to the presence of a small amount of this body.

MOLLUGO STRICTA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 26.

Hab.—Throughout India. The plant.

MOLLUGO SPERGULA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 24.

Hab.—Throughout India, except the N.-Western districts.

Vernacular,—Jima (*Hind., Beng.*), Toora-elley, Kacchantharai (*Tam.*), Chayntáráshiákoo (*Tel.*), Jharasi (*Mar.*), Kaipajira (*Mal.*), Parpataka (*Can.*).

History, Uses, &c.—These plants are called in Sanskrit Grishma-sundaraka and Phani-ja, and are in general use as a pot herb. The Hindi name is derived from the Sanskrit जिम or जम, to eat. Medicinally they are considered to be stomachic, aperient and antiseptic.

Rheede, speaking of *M. stricta*, says:—"Apozema ex tota hac planta confectum choleræ medetur; præparatur et ex illa balneum contra variolas. Succus vino permixtus, tridui spatio bis de die assumptus, variolas expellit, febrem concomitantem minuit." Ainslie (ii., 431,) writes to the same effect concern-

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ing *M. Spergula*, and adds that the plant is administered for suppression of the lochia, and when applied warm and moistened with a little castor oil, is reckoned a good application for earache. He considers that it is justly held in estimation by the native practitioners. In Pudukota the juice of *M. Spergula* is applied to itch and other skin diseases, and that of *M. hirta* (Sirooseroopadi, *Tam.*,) is administered internally to weak children. The latter plant is stated by Watt to be prescribed in the Punjab and Sind for diarrhœa under the names of Poprang, Gandi-buti and Kottruk.

Description.—*M. stricta:* Glabrous, stems much branched, leafy, often a foot high in rich wet soil, sometimes only a few inches where the situation is unfavourable Leaves ¾ to 1½ in., whorled or opposite, from lanceolate acute to obovate obtuse, much narrowed at the base; petiole hence obscure. Cymes compound, the branches sometimes racemed. Sepals $\frac{1}{16}$ in., elliptic or round. Stamens 3 to 5, filaments dilated. Styles 3, short, linear. Capsule as long as the sepals, globose, many-seeded, the walls thin. Seeds dark chestnut-coloured; embryo curled into three-quarters of a complete circle. (*Fl. Br. Ind.*)

M. Spergula: Glabrous or nearly so, branching, diffuse, leafy. Leaves ½ to 1 in., usually whorled, spathulate lanceolate or elliptic; petiole 0 to ⅛ in. Pedicels ⅛ to ½ in. Sepals ⅛ to ½ in., oblong, margins often membranaceous. Stamens 5 to 10. Stigmas 3, minute. Capsule ellipsoid, a little shorter than the sepals. Seeds many, covered with raised tubercular points, and appendaged by a minute short subulate bristle, and sometimes by a second, yet more minute bristle. (*Fl. Br. Ind.*)

Chemical composition.—The bitter principle of *M. stricta* is soluble in ether, alcohol and water, and is precipitated from the aqueous solution by tannin, but not by neutral lead acetate. It solution does not respond to alkaloidal tests, and it is decomposed by boiling with dilute hydrochloric acid. Evaporated portions dissolve in strong sulphuric acid with a brown colour. A bitter resin is also dissolved out of the herb by rectified spirit, and the chief constituent of the watery extract

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is a gum gelatinizing with ferric chloride. The dried herb deflagrated occasionally during the process of combustion in the open air; this was found to be due to the presence of alkaline nitrates. The white ash amounted to 68·1 per cent.

GISEKIA PHARNACEOIDES, *Linn.*

Fig.—*Wight Ic., tt.* 1167, 1168.

Hab.—The Punjab, Sind, South Deccan Peninsula, Ceylon. The plant.

Vernacular.—Bálu-ka-ság (*Hind.*), Walu-chi-bháji (*Mar.*), Manal-kirai (*Tam.*), Isaka-dasarikura (*Tel.*), Attirilla-pála (*Cing.*), Báluka (*Beng.*).

History, Uses, &c.—This plant is called in Sanskrit Bálu, Báluka, Váluka and Elaváluka on account of the number of large raphides contained in the leaves, and which give them the appearance of being full of sand (válu). Báluka is considered by the Hindus to be aromatic, aperient and anthelmintic, and is used as a vegetable like the Mollugos; the Hindi and Marathi names signify "sandy potherb." Capt. W. H. Lowther (*Journ. of Agri.-Hort. Soc. of India*, 1857, vol. ix., p. 285,) appears to have been the first to bring the anthelmintic properties of this plant to the notice of Europeans. The fresh plant, including the leaves, stalks, and capsules, is directed to be employed in cases of tænia, in doses of about an ounce, ground up in a mortar with sufficient water to make a draught. This is to be repeated three times at an interval of four days, the patient each time taking it after fasting for some hours.

Description.—A diffuse branched herb, Leaves opposite or falsely whorled, fleshy, $\frac{3}{4}$ to $1\frac{1}{2}$ in., oblong or elliptic, entire, narrowed at the base; petiole 0 to $\frac{1}{4}$ in. Sepals $\frac{1}{16}$ in. Filaments dilated below. Carpels usually 5, in fruit as long as the sepals. Seeds blackish, smooth, minutely glandular-punctate; embryo curved less than a semicircle. (*Fl. Br. Ind.*)

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Chemical composition.—The most interesting principles present in the seeds are astringent principles which we provisionally call α and β *Gisekia tannin.* α Gisekia tannin is obtained by agitating an alcoholic extract of the seeds with ether, it forms an orange varnish, in which nodules gradually form on standing, which on microscopic examination are seen to consist of narrow plates and a few needles of a deep yellow colour. The ether extract is easily soluble in alkalies with deep orange coloration, and is reprecipitated by acids in yellow flocks. In water the ether extract is nearly wholly soluble with yellow colour and astringent taste. Ferric and ferrous salts give a dirty deep brown coloration, without any tinge of blue. Potassium cyanide a deep orange coloration. Both acetates of lead gave a dirty yellow precipitate; cupric sulphate no precipitate. Lime water in excess a dirty reddish precipitate; Barium chloride and ammonia a similar precipitate. Potassium bichromate deep yellow, slowly changing to yellowish brown. Bromine water dirty brownish yellow. It reduces an alkaline copper solution on boiling and precipitates gelatine in white flocks.

β Gisekia tannin occurs as a deep orange powder, and is obtained by acidulating the aqueous alcoholic extract after agitation with ether, when the tannin is precipitated. In cold water it is slightly soluble, but dissolves easily in boiling water with a yellow coloration, the liquid becoming turbid on cooling. It is easily soluble in amylic alcohol Ferric salts afford a nearly black precipitate, without any tinge of blue. In alkalies it dissolves with a wine red coloration, the tint being brighter with ammonia than with the fixed alkalies. Potassic cyanide gives a similar coloration. Both acetates of lead afford flesh coloured precipitates. Bromine water a yellowish precipitate, sulphate of copper whitish. It precipitates gelatine in white flocks, and reduces slightly an alkaline copper solution on boiling.

We failed to detect any alkaloidal principle in the seeds. The anthelmintic properties of the seeds are very probably due to these tannin-like principles.

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Commerce.—The seeds under the name of Baluka are sold by druggists in Bengal.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, *Linn*

Fig.—*Hort. Mal. x.*, 46; *Wight Ic.*, t. 565; *Bentl. and Trim.*, *t.* 117. Indian Pennywort (*Eng.*), Bevilacque (*Maurice*).

Hab.— India. The plant.

Vernacular.—Brahmamanduki, Khulakhudi, Brahmi (*Hind.*), Thalkuri (*Beng.*), Karivana, Karinga (*Mar.*), Vallárai (*Tam.*), Khar-brahmi, Khi-brahmi (*Guz.*), Babassa (*Tel.*), Ondelaga (*Can.*).

History, Uses, &c.—In Sanskrit works this plant is called Brahmi and Mandukaparni Chakradatta directs the fresh juice to be given with milk and liquorice. In the Nighantas it bears many synonyms, and is described as cold, moist, sweet, light and alterative; it is said to improve the memory and understanding, and to cure leprosy, jaundice, gonorrhœa and fever. The plant was known to Rheede by its Malayalim name of Codogam or Kutakan, and also to Rumphius. Ainslie informs us that an infusion of the toasted leaves in conjunction with fenugreek is given to children suffering from bowel complaints and fever in doses of half a teacupful, also that the leaves on the Coromandel Coast are applied to parts that have suffered from blows and bruises, having, it is supposed, the power of keeping off inflammation. In Java, according to Horsfield, they are considered diuretic, and on the Malabar Coast the plant is one of the remedies for leprosy. As a remedy in this disease it was first brought prominently to notice by Boileau, in 1859. Dr. A. Hunter, who tried it in the Madras Leper Hospital, came to the conclusion that it had no claim to consideration as a specific in leprosy, but he found it most useful in ameliorating the symptoms and improving the

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general health. In the *Pharmacopœia of India* it has been made official, and is described as an alterative, tonic and local stimulant, more especially useful in syphilitic skin diseases, in which it may be used both as an internal and local remedy. Directions for making a powder and poultice are given. More recent reports from Europe (1885) confirm this statement, and there has been some enquiry for the drug in Bombay which has led to its cultivation on a small scale. In the neighbourhood of Bombay the plant is rare in a wild state, but may often be seen in gardens; it is a popular remedy for the slight dysenteric derangements of the bowels to which children are subject; 3 to 4 leaves are given with cumin and sugar, and the pounded leaves are applied to the navel. In the Concan one or two leaves are given every morning to cure stuttering; and the juice is applied to skin eruptions supposed to arise from heat of blood.* Dr. Clement Daruty de Grandpré (*Nouveaux Remédes, 8th April,* 1888,) states that this plant is so abundant in Mauritius that it serves as forage for cattle, whose milk it improves; it is also greedily eaten by pigs and other domestic animals. He says it should be very carefully dried and bottled to preserve the volatile oil which is the active principle, the whole plant should be used, including roots and fruit, as he finds it more active than the leaves only. Dr. Daruty observes that the administration of this drug to lepers causes at first a sensation of warmth and pricking in the skin, especially of the hands and feet; this is followed after a few days by a general sensation of warmth, sometimes almost unbearable; the capillary circulation is accelerated, and after about a week the appetite improves, and in time the skin becomes softer, throws off the thickened epidermis, and recovers its transpiratory function. Hydrocotyle augments the excretions from the bowels and kidneys. The dose is 10 grs. of the powder three times a day; in short, this drug is in small doses a powerful stimulant, especially of the cutaneous system, with the results above described in the case of lepers. In large doses it

* Generally as a *lép* with Cadamba bark, Ghi, and Black Cumin.

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acts as a stupefying narcotic, producing headache, giddiness, and with some people a tendency to coma.

Description.—The plant grows freely all the year round if watered, sending out long runners, which produce leaves, roots and fruit at the joints. The peduncles and petioles are fascicled; the latter are frequently three to four inches long; the peduncles are very short, and bear a 3 or 4-flowered simple umbel with very short rays; the leaves are reniform, crenate, ½ to 2 inches in diameter, 7-nerved, glabrous, or when young somewhat hairy on the under side; the fruit is laterally compressed, orbicular, acute on the back; the mericarps reticulated, sometimes a little hairy, with 3 to 5 curved ribs; they have no vittæ. The fresh herb has an aromatic somewhat ivy-like odour when crushed and a nauseous bitter taste, but these qualities are to a great extent lost in drying.

Chemical composition.—Hydrocotyle has been analysed by Lépine of Pondicherry (*Journ. de Pharm. et de Chim.* [3] xxviii., p. 46), who found in it a peculiar body which he named *Vellarin*, and described as being obtainable from the dry plant to the extent of 0·8 to 1·0 per cent. He describes it as an oily non-volatile liquid, with the odour and taste of the fresh herb, soluble in spirit, ether, caustic ammonia, and partially in hydrochloric acid, and volatilizing at 120°. The authors of the *Pharmacographia* remark that these singular properties do not enable us to rank vellarin in any well characterised class of organic compounds; moreover, they failed to obtain anything like it from the dry herb.

We find that the fresh leaves contain about 78 per cent. of water.

Distilled with water some traces of a stearopten-like body were condensed and the distillate was neutral. The ether extract contained a white crystalline substance possessing the odour of the drug, with resin and fat amounting to 8·9 per cent. of the dried leaves. Alcohol dissolved 24·5 per cent. of tannin and sugar, the tannin gives a bulky green precipitate with ferric chloride and neutral acetate of lead, dissolves in alka-

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line solutions, and is reprecipitated by acids. 11·5 per cent. of gum, sugar, and salts was extracted by water, and 12·5 per cent. of albuminous matter by diluted caustic soda. The powdered leaves yielded 12·4 per cent. of ash, nearly half of which consists of alkaline sulphates. Lépine's vellarin was most probably a mixed substance composed of the odorous fatty body with some resin.

Commerce.—The dried herb is kept by the duggists. Value, Rs. 7 to 8 per Surat maund of 37½ lbs. It is generally much mixed with grass and weeds.

CONIUM MACULATUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 118. Hemlock (*Eng.*), Cigue (*Fr.*).

Hab.—Europe, Northern Asia. The fruit and root.

Vernacular.—Kirdamána, Kurdumána,* Khorasani-ajwán (*Ind. Bazars*).

History, Uses, &c.—We have met with no mention of Hemlock in Hindu works on Materia Medica. It is now generally admitted to have been the κώνειον of Greek writers, the celebrated *Athenian state poison*, by which Socrates died, and the Cicuta of the Romans.† Moreover, κώνειον is the modern Greek name for Hemlock. Ibn Sina identifies the شوكران (hemlock) of the Arabs and Persians with the κώνειον of Dioscorides. Ibn Baitár and Háji Zein-el-attár (A.D. 1368) also identify Showkrán with the κώνειον of the Greeks and Cicuta of the Romans; the former tells us that it is called Hafúz in Spain, and the latter writer says that it is known as *Dúras* in the district of Yezd, and that the best is obtained from the hills

* Kurdumána according to the Burhán, where it is described as wild caraway, mountain caraway, Syrian caraway and Turkish caraway. The author of the Makhzan describes Kurdamána as an aromatic seed, and does not identify it with Conium.

† See Theophrastes H. P., i., 8; vi, 2; ix., 8. Dioscorides iv., 77; vi., 11. Pliny 25, 95. Plato, Lys. 219 E; Xenophon Hell. 2, 3, 56. Hippocrates 681, 4.

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of Taft and is called *Duras-i-Tafti*, and its root *Bikh-i-Tafti*; he describes the symptoms of poisoning by hemlock very correctly, and its termination by convulsions and failure of the respiration. The Indian bazar names, which signify "Syrian or wild caraway" and "Khorasán Ajowan" are apparently euphemistic.

The ancients were well acquainted with the properties of hemlock, and it is said that the priests of Eleusis, who were under a vow of chastity, used to rub their bodies with its juice. The Arabian and Persian physicians repeat almost word for word the opinions held by the Greeks concerning the medicinal properties of the plant; these opinions it is unnecessary to recapitulate, as they were those held by modern European physicians up to a comparatively recent date. The preparation of the plant recommmended for medicinal use by the Arabians is an extract made by expressing the juice of the unripe fruit and drying it; this preparation is doubtless far more efficient than the extract and tincture of our Pharmacopœias. Harley (*The Old Vegetable Neurotics*, 1869,) has shown that the green unripe fruits are the most active part of the plant, and that they may be even dried without loss of activity. Fróm modern pharmacological research we learn that coniine paralyses the ends of the motor nerves and of the vagus, like curare, and afterwards paralyses the motor centres in the brain and spinal cord. It causes death by paralysing the respiratory muscles. Death is usually accompanied by convulsions in warm, but not in cold-blooded animals. There is dilatation of the pupil and ptosis from paralysis of the endings of the third nerve. Locally applied, it appears to paralyse the ends of the sensory nerves. Methyl-coniine acts on the spinal cord, causing paralysis of reflex action. Dimethyl-coniine and conhydrine have an action similar to that of coniine, but less powerful. (*Lauder Brunton.*)

In Europe hemlock is now chiefly used as a neurotic, the expressed and preserved juice of the unripe fruit being preferred to the old preparations, which contain hardly any of the active principles. It has been tried in tetanus and strychnia

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poisoning, but without success. In the East it is prescribed as a neurotic in painful affections of the skin and subjacent tissues, and as an antaphrodisiac. Mir Muhammad Mumin has a curious preparation in the Tuhfat, which he has named "*Umru's raisins,*" and which he recommends as a preservative of the seminal fluid. It is made by stewing together 5 dirhams each of hemlock root and hyoscyamus seeds with 150 large raisins and 150 miskals of water until dry; the raisins are then removed and preserved. The dose is from one to three daily.

Description.—Kirdamana resembles English hemlock fruit, but is a little larger and of a darker grey colour; it appears to have been collected when mature or nearly so. If a section of the fruit is examined under the microscope it will be seen that there are no vittæ, and that the cells of the endocarp contain a brown substance, which consists of coniine and the other alkaloids together with a small quantity of volatile oil. Surrounding the albumen is a peculiar layer of small cubic cells. When crushed in a mortar with a few drops of *liquor potassæ,* kirdamana seeds have a mousey odour.

Chemical composition—The most important constituent of hemlock fruit is the volatile alkaloid coniine ($C^8H^{17}N$), a colorless, inflammable, oily fluid, specific gravity ·846 at 12°·5 C. Coniine has a strong alkaline reaction, a penetrating suffocating odour, and boils when pure at 168° to 169° C. It is soluble in all proportions in alcohol, ether, chloroform, benzol, benzine, and fixed oils, is less freely soluble in carbon bisulphide, and requires 100 parts of cold water for solution. Like ammonia, it forms dense white fumes with volatile acids, it precipitates most metallic salts, some of the precipitates, like silver, being soluble in an excess. It neutralizes acids, forming salts which are freely soluble in water and alcohol, are usually deliquescent, and occasionally uncrystallizable, and are not precipitated by platinic chloride. Its hydrochlorate and hydrobromate are, according to A. W. Hofmann (1881), easily obtained by dissolving coniine in anhydrous ether and passing into the solution dry hydrochloric or hydrobromic acid gas. The salts, being

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insoluble in ether, are precipitated in a white crystalline form; both are very soluble in water and alcohol, are not deliquescent and may be dried at 100° C. without decomposition.

Coniine is accompanied by *Conhydrine* ($C^8H^{17}NO$) and often by Methyl-coniine ($C^9H^{17}N$), the former of which is left in the retort on the careful distillatior of crude coniine. Hemlock fruit contains also a fixed oil, a minute portion of non-poisonous volatile oil having the odour of cumin, and probably malic acid in combination with the alkaloids. The fully grown green fruit yields about 0·8 per cent. of coniine, *conhydrine* is always present in a very small proportion. According to Wernecke the fruit yields 6·69 per cent. of ash.

Coniine has been made synthetically by Ladenburg and its nature and derivation clearly shown. It is the dextro-rotatory *a* normal propyl-piperidine. In obtaining it, pyridine is first converted into *a* allyl-pyridine, which reduced by sodium in alcoholic solution yields an optically inactive *a* normal propyl-piperidine. The tartrate of this base is made and crystallized, when, following the analogy of the splitting of racemic acid into dextro-rotatory and lævo-rotatory tartaric acid, we get a dextro and a lævo coniine, of which the first is the true alkaloid of hemlock.

Toxicology.—No cases of hemlock poisoning appear to have been recorded in India. For white mice the lethal dose is ·0758 grm. per kilo body weight; whilst ·075 grm. does not cause death. (*Ladenburg.*)

Commerce.—The Persian seed is sold for Re. ½ per lb.

CUMINUM CYMINUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 134. Cumin (*Eng., Fr.*).

Hab.—Africa. Cultivated in India. The fruit.

Vernacular.—Jira, Safed-jira (*Hind., Beng.*), Shiragam (*Tam.*), Jilakara, Jiraka, Jirana (*Tel.*), Jirakam (*Mal.*), Jirige (*Can.*), Jiré (*Mar.*), Sufed-Jirun (*Guz.*).

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History, Uses, &c.—The use of cumin as a spice and medicine is of the highest antiquity, and appears to have spread from the cradle of civilization in Egypt to Arabia, Persia, India and China. Cumin is mentioned in the Hebrew Bible, it is the κύμινον of the Greeks, and Theophrastus (H. P. IX.) tells us that it was the custom to utter curses when sowing it (probably to avert the evil eye). Dioscorides (iii., 61,) calls it κύμινον ἥμερον, and notices its medicinal properties; in the same chapter he mentions another kind of cumin, "the king's cumin of Hippocrates," which the Arabians identify with *ajowan*, and in the next chapter two kinds of wild cumin. Popular allusions to cumin are common in the writings of the Greeks and Romans, cumin and salt was a symbol of friendship (*Plut. Symp.* 5, 10, 1). Pliny tells us that students eat it to make themselves look pale and interesting. Greek writers mention a κυμινο-δοκον or cumin-box which was placed on the table like a salt-cellar. Flückiger and Hanbury trace its use during the Middle Ages, when it appears to have been much valued in Europe. Mannhardt (*Baumkultus der Germanen*) says that bread was spiced with cumin to protect it from the demons, and De Gubernatis (*Myth. des Plant.*) states that it is used for the same purpose in Italy, and on account of its supposed retentive powers is given to domestic animals to keep them from straying, and by girls to their sweethearts for the same reason.

Jira and Jirana, the Sanskrit names for cumin, as well as the Persian Zhireh or Zireh, and all the Indian vernacular names appear to be derived from the root Jri, and to allude to the digestive properties of the seeds; other Sanskrit names are Ajáji "that overcomes goats," ajamoda "goat's delight" and Kunchicka. The Arabic name Kamún is doubtless derived from the Greek. Ibn Sina and the Eastern Arabs, and also the Persians follow Dioscorides in describing four kinds of cumin, which they name Kirmáni or black, Farsi or yellow, Shámí (Syrian) and Nabti (Egyptian). They also mention along with them Karawya or caraway as a seed like anise. In the absence of accurate descriptions it is impossible to say what

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these four kinds were, but it seems probable that the Kirmáni or black cumin is correctly identified by the Indian Mahometans with the seeds known in India as Siyah-Jira, a species of caraway peculiar to Central Asia. The Nabti or Egyptian kind is probably true cumin.

Cumin is much used as a condiment in India, and is an essential ingredient in all the mixed spices and curry powders of the natives. Medicinally they regard it as stomachic, carminative and astringent, and prescribe it in chronic diarrhœa and dyspepsia. A medicinal oil is expressed from the seeds. Cumin is applied in the form of a plaster to allay pain and irritation. It is thought to be very cooling, and on this account it is an ingredient in most antaphrodisiac prescriptions, and is administered in gonorrhœa.

Description.—The fruit consists of two mericarps which remain united together when dry, and form an elongated ovoid body about $\frac{1}{4}$ inch long and $\frac{1}{10}$ broad in the middle, surmounted by the styles; each mericarp has five primary ridges and four secondary, the vittæ are six in number, two of them being situated on the commissural side; the seed is pentangular with rounded angles.

Chemical composition.—Cumin fruits yielded to Bley (1829) 7·7 per cent. of fat oil, 13·5 per cent. of resin, 8 of mucilage and gum, 15·5 of protein compounds, and a large amount of malates. Their peculiar, strong, aromatic smell and taste depend on the essential oil, of which they afford about 4 per cent. It contains about 56 per cent. of *Cuminol* (or *Cuminaldehyde*), $C^{10}H^{12}O$, a liquid of sp. gr. 0·972, boiling point 237° C. By boiling cuminol with potash in alcoholic solution, cuminalcohol, $C^{10}H^{14}O$, as well as the potassium salt of cuminic acid, $C^{10}H^{12}O^{2}$, are formed.

The oil of cumin, secondly, contains a mixture of hydrocarbons. That which constitutes about one-half of the crude oil was first obtained in 1841 by Gerhardt and Cahours and called *Cymene* or *Cymol.* It is a liquid of sp. gr. 0·860 at 15° C. boiling at 175° C. and has a lemon-like odour.

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Cymene $C^{10}H^{14}$ may also be artificially obtained from a large number of essential oils having the composition $C^{10}H^{16}$, $C^{10}H^{14}O$, $C^{10}H^{16}O$, or $C^{10}H^{18}O$. It differs very remarkably from the oil of the formula $C^{10}H^{16}$, inasmuch as cymene yields crystallizable cymensulphonic acid, when it is warmed with concentrated sulphuric acid.

There is also present in oil of cumin a small amount of a terpene, $C^{10}H^{16}$, boiling at 155°·8 C.

Warnecke obtained 8·09 per cent. of ash from cumin fruit.

Commerce.—Cumin is grown in Northern India and is also imported from Persia and sometimes from Asia Minor. The exports, which range from 10 to 12 thousand cwts., are chiefly to Eastern ports, many of them Indian, Europe only taking from 500 to 600 cwts. The average value in India may be stated at from Rs. 6 to 8 per Surat maund of 37½ lbs.

CARUM COPTICUM, *Benth.*

Fig.—*Wight Ic.*, *t.* 566; *Jacq. Hort. Vind*, *tt.* 52, 200; *Bentl. and Trim.*, *t.* 120. Bishop's weed, Lovage (*Eng.*), Ammi de l'Inde (*Fr.*).

Hab.—Africa, cultivated in India. The fruit.

Vernacular.—Ajwain, Ajwán (*Hind*), Joán, Ajowán (*Beng.*), Ova, Ajma (*Mar.*), Ajamo (*Guz.*), Omam (*Tam.*), Omamu, Vámamu (*Tel.*), Omu (*Can.*).

History, Uses, &c.—A small African seed called αμμι is described by Dioscorides (iii., 63); it had an odour like *origanon*, was of a very hot and dry nature, and was used as a carminative, &c. This seed was also called βασιλικὸν κύμινον or "king's cumin." A similar, if not identical drug is mentioned by early Sanskrit writers under the name of Yaváni or Yavánika, "of foreign origin," and appears to have been one of several seeds to which the name Ajmoda was also applied. In Persia also a similar seed was in use from a very early date as a seasoning for bread, under the names of zhinian (زنيان) and nánkháh (نانخواه), the latter name being a compound of *nán* 'bread'

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and *kháh* 'relish.' Ibn Sina notices it under the name of Nankhah, but does not identify it with any of the kinds of cumin which he mentions. Pliny (20, 58,) says that ammi and king's cumin are considered to be identical. Haji Zein-el-Attár (A. D. 1368) identifies *nankhah* with the ammi of Dioscorides and Paulus Ægineta, and quotes the opinions of those physicians concerning its medicinal properties. He also informs us that the drug has a reputation for its antiseptic properties, and is used to promote the healing of foul sores, and to remove the offensive odour of the discharges from them.

The author of the Tuhfat-el-muminin, and other Mahometan physicians, who have written in India, identify Ajowán with the *ammi* or *basilikon kuminon* of Dioscorides, and also with the *zhinian* and *nánkháh* of Persia; they give it the Arabic name of Kamún-el-mulúki, "king's cumin."

The authors of the *Pharmacographia* speaking of Fructus Ajowan, remark: "Owing to their having been confounded with some other very small umbelliferous fruits it is difficult to trace them precisely in many of the older writers on Materia Medica. It is however probable that they are the *Ammi* of Anguillaria (1561), and the *Ammi perpusillum* of Lobel (1571), in whose time the seeds were obtained from Egypt. They are certainly the *Ajave seeds* of Percival (1773), who obtained them from India." The plant is the *Ptychotis Ajowán* of later European writers on Indian Materia Medica.

In native practice, ajowán is much used as a carminative, either alone or in combination with rock salt, asafœtida, myrobalans, &c. It is also thought to check discharges of a chronic kind, and is therefore used in making lotions, collyria, &c.; upon the same principle it is prescribed in bronchitis with copious expectoration. A plaster or poultice of the crushed fruit is said to relieve pain. The *Ark* or distilled water of ajowan is prepared and sold in the bazars, and the stearopten under the name of *Ajowan ke phúl* (flowers of ajowan) is prepared at Oojein and elsewhere in Central India, by exposing the oil to spontaneous evaporation at a low temperature.

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Description.—The fruits are of the size and shape of those of parsley, of a greyish-brown colour, with a tubercular surface. Each mericarp has five prominent ridges, the intervening channels being dark brown, with a single vitta in each. The commissural side bears two vittæ. The odour resembles that of thyme.

Chemical composition.—The fruits according to Stenhouse (1855) yield 5 to 6 per cent. of an agreeably aromatic, volatile oil, sp. gr. 0·896. At the same time there collects on the surface of the distilled water, a crystalline substance. This stearopten, under the name of *Ajowan-ke-phul*, was first made known by Stocks, and was examined by Stenhouse and by Haines, who showed its identity with thymol, as contained in *Thymus vulgaris*. (*Pharmacographia.*) Thymol is the phenol of cymene, and its composition is shown by the formula C^6H^3, C^3H^7, CH^3, OH. Widman (1882) has succeeded in preparing it synthetically from cuminol by converting this into nitrocuminol, acting upon this with phosphorus pentachloride, when nitro-cymylene chloride, $C^{10}H^{11}(NO^2)Cl^2$, is formed, and treating this with nascent hydrogen, first at a low temperature, afterwards with the aid of heat, to obtain cymidin, $C^{10}H^{13}$, NH^2. A dilute solution of cymidin sulphate is treated with potassium nitrite, and finally distilled, when thymol is obtained, having the melting-point 44° C., which is the same as found by Lallemand and Stenhouse for thymol from the oils of thyme and of ajowan. (*Stillé and Maisch*) Thymol is most conveniently and completely extracted from oil of ajowan by shaking it repeatedly with caustic lye, and neutralizing the latter.

According to Wernecke ajowan seeds yield 10·45 per cent. of ash.

Cultivation and Commerce.—Ajowan is cultivated on the plains of India along with coriander, fenugreek and other crops which require similar treatment. The sowing season is October to November; the reaping time is February. The soil required is a deep rich loam thoroughly worked and manured with a small quantity of ashes from fuel prepared from

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cattle droppings. Strong manures are considered injurious to this crop. During the growing season of ajowan the climate is comparatively cool and very dry, rain falls at very irregular intervals, but at the sowing season, the soil will probably be saturated with moisture, and heavy dews prevail during the early half of the growing season. The temperature in the shade varies from 80° to 50° F.

Rain or irrigation to the extent of about ½ inch weekly is required, therefore the soil is prepared for irrigation by making level beds about 8 feet square enclosed by ridges about six inches high. The ajowan is sown on the ridges by dibbling in the seeds about 6 inches apart, and coriander or fenugreek occupies the central bed. Assuming that the whole field was occupied by ajowan the quantity of seed required per acre would be 10 lbs., and the out-turn nearly 100 lbs. (*G. M. Woodrow.*) The average value of ajowan seed is about Rs. 2 per pharrah (35 lbs.). In 1881-82, Bombay exported 1,195 cwts. of the seed valued at Rs. 6,066.

The crude thymol manufactured in India has an average value of Rs. 8 per lb.

CARUM CARUI, *Linn.*

Fig.—*Bentl. and Trim., t.* 121. Caraway (*Eng.*), Carvi (*Fr.*).

Hab.—Cashmir, Gurhwal, Persia. The fruits.

Vernacular.—Indian caraways: Siyah-jira (*Hind.*), Guniyún (*Cashmere.*), Umbhú (*Ladak.*), Sa-jirè (*Mar.*), Shimai-shiragam, Pilappu-shiragam (*Tam.*), Sima-jilakara (*Tel.*), Shime-jirige (*Can.*), Shia-jira (*Beng.*), Kalun-jirun (*Guz.*).

European caraways: Vilayati-jira (*Hind., Mar., Guz.*), Kekku virai, Shimai-shombu (*Tam.*), Kekku-vittulu, Shima-sopu (*Tel.*) Shime-sopu (*Can.*), Bilati-jira (*Beng.*).

History, Uses, &c.—A kind of caraway called Sushava and Krishna-jiraka* or "black cumin" appears to have been

* This name is also applied to the seeds of *Nigella sativa.*

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known to the Hindus before the introduction into India of European caraway seeds. Royle is the first European writer who notices *Zeera seeah* as a kind of caraway imported from Kunawar, and as they are of a much darker colour than ordinary caraways he named them *Carum nigrum* (*Him. Bot.* 229). Stewart reduces Royle's *C. nigrum* to *C. Carui*, and in this view he appears to be supported by Mr. C. B. Clarke in the *Flora of British India*. The same variety of caraway is known in Persia as Zireh-i-siyah, and as it is principally cultivated in the neighbourhood of Kirmán, is also called Zireh-i-Kirmáni.

The European caraway is first mentioned by the Arabians under the name of Carawiya. Ibn Sina, Edrisi and Ibn Baitar all treat of it as distinct from cumin. The καρον of the Greeks, so often identified with the caraway, appears to have been quite a different plant, as it afforded a root in common use as a vegetable which Paulus Ægineta classes with parsnips and carrots. The Mahometan physicians derive the name Karawiya or Kuruya from the Syrian Kârui, and give ἀρμένιον as the Greek for caraways, a word applied by Greek and Latin writers to several of the products of Armenia. They describe the seeds as aromatic, carminative and astringent; from them they prepare an eyewash, which is supposed to strengthen the sight; they are also used as a pectoral, and considered to be diuretic and anthelmintic. A caraway bath is recommended for painful swellings of the womb, and a poultice for painful and protruding piles.

Description.—The fruits are ovoid, slightly arched, laterally compressed, crowned by the style; they vary in size, but are generally about 1-6th of an inch long and 1-20th in diameter. The colour is brown, but the ribs are of a lighter colour than the furrows. The mericarps are generally separated; each on transverse section is seen to have five ridges, and to be of a pentagonal form with unequal sides; between the ridges are four vittæ, the commissural side being provided with two, which are placed close together. Within the pericarp is the seed, which is conform to the fruit. Caraways, like cumin,

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have a powerful odour. The black caraway approaches very nearly to cumin both in odour and flavour, the fruit is more slender and of a darker colour than the common caraway, but a transverse section shows a similar structure.

Chemical composition.—Trommsdorff besides volatile oil found in caraways a green fixed oil, a little wax, resin, sugar, mucilage, and some tannin. By repeated fractional distillation Völkel (1840) separated *carvene,* $C^{10}H^{16}$, which has little odour and taste, boils at 173° C., and has a strong dextrogyrate rotation. The higher boiling fraction contains *carvol,* $C^{10}H^{14}O$, which is liquid, has an agreeable caraway odour, boils at 227° C. (*Gladstone*) or at 250° C. (*Varrentrapp*), and has a levogyrate rotation. Carvol is isomeric with menthol, myristicol, thymol, and cumin alcohol. According to Warnecke the fruit yields 5·27 per cent. of ash.

Commerce.—European caraways are imported into India from England, and occasionally from the Levant, and are sold for about Re. 1 per lb. The black caraway is imported into Northern India from Afghanistan, Cashmere, and other parts of the Punjab Himalaya, also from Persia. The average value is Rs. 8 per Surat maund of 37½ lbs. if purchased in bulk, but as the bales contain much trash, the retail price of the clean seeds is not less than 8 annas per lb. In 1881-82 the imports into Bombay from Persia amounted to 2,683 cwts., valued at Rs. 71,886. The exports were 5 cwts. to Mauritius and 4 cwts. to Aden.

Carum Roxburghianum, *Benth. Wight Ic.* 567, Ajmod (*Hind.*), Rándhani (*Beng.*), Rándhani, Karonjha (*Mar.*) is an herbaceous plant resembling single parsley, and is supposed to be a cultivated form of *C. stictocarpum* common in the Concan, and bearing the same Marathi name as the cultivated plant. In many parts of India it is cultivated for its fruit, which is used in native cookery; elsewhere it occurs as a weed of cultivation, or is grown on a small scale to be used instead of parsley, for which it is a fair substitute, though objected to

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by some on account of its coriander-like flavour. It is worthy of remark that the Marathi name rán-dhani (wild coriander) is in use in Bengal. The fruit of this plant must not be confounded with the Bori-ajmod or Tukm-i-karafs of the shops, which is celery fruit imported from Persia. Rándhani is sometimes used as a carminative in dyspepsia, and is probably a fair substitute for caraways. The fruit is about $\frac{1}{12}$ of an inch in length, and is studded with blunt simple hairs; each mericarp has five ridges, which are paler than the spaces between them, and about 15 vittæ. The wild form (*C. stictocarpum*) is a much more slender plant, and has fruit about half the size of the cultivated variety.

APIUM GRAVEOLENS, *Linn.*

Fig.—*Eng. Bot. xvii., t.* 1210. Celery (*Eng.*), Céleri (*Fr.*).

Hab.—N.-W. Himalaya, Persia. The fruit.

Vernacular.—Karafs (*Arab., Ind. Bazars*), Ajmod (*Hind.*), Bodiajamo (*Guz.*).

History, Uses, &c.—Celery does not appear to have been known to the ancient Hindus. The Arabians probably obtained their knowledge of it from the Greeks. Dioscorides describes five kinds of σελίνον. Sprengel refers two of these to *Apium graveolens, viz.,* σελίνον κηπαῖον and ἐλειοσέλινον, var. *sativum et sylvestre.** The Selinon of Theophrastus (*H. P.* i., 15, 16, 19; iv. 9, viii. 5) was probably Celery; he also mentions Eleioselinon (vii., 6). Hipposelinon (ix., 1.), a diuretic, the root yielding a gum like scammony and Oreoselinon (vii., 6). Muhammad Husain, who wrote in India about one hundred and twenty years ago, informs us that Karafs is the celery of the Europeans and the Udasaliyun of the Greeks. He describes three other kinds, *viz.,* Sakhrí, in Greek Fiturasaliyun; Nabti, in Greek Akùsaliyun; and Tari, in Greek Shamaríniyun. What

* Conf. Dios. iii., 67, 68, 69, 70, 71. Hipp. περί νουσεων ii. 19. περὶ διαιτης ii, 25. περὶ παθων 48. The Ancients made chaplets of celery, which were given to the victors at the Isthmian and Nemean games, and hung upon tombs. It is the Apium of Pliny; 19, 46.

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all of these may be, it is difficult to decide. Fiturasaliyun is now the bazar name in Bombay for the fruits of *Prangos pabularia*, but it is evidently a corruption of the Greek Petroselinon, and had once a different meaning, being described in Arabic works as like Ajowan.* The fruits imported into Bombay from Persia under the name of Karafs, and sold in the bazars as Borí-ajmúd, agree in structure with those of *A. graveolens*. Mahometan writers describe Karafs as deobstruent and resolvent, and use it in the form of a poultice with barley meal; they recommend it internally as a pectoral and as a tonic and carminative adjunct to purgatives, also as a diuretic, emmenagogue, lithontriptic, and alexipharmic.

In European medicine *apiol*, a camphor common to the fruits of this plant and of parsley, has been recommended as an emmenagogue and febrifuge, but more exact observation has proved its inutility. The physiological effects produced by this substance are headache and passing intoxication, and after repeated ingestion, digestive disturbances, loss of appetite, and even fever.

Description.—Karafs or Borí-ajmud imported into Bombay from Persia is a very small fruit, which, when the two mericarps are united, as is often the case, is almost globular; it is quite smooth and remarkable for the size and prominence of its ridges; the vittæ are 11 to 12 in number, two of these are on the commissural side. The taste is at first like anise, but afterwards bitter. The odour like anise, but faint.

Chemical composition.—Celery seeds, like those of parsley, contain *Apiin*, a substance first obtained by Rump in 1836 from the leaves, stalks, and seeds of common parsley; it was afterwards more exactly examined by Lindenborn, who obtained it by careful evaporation of the alcoholic solution in needles, which gave by analysis 54·71—55·25 per cent. carbon and 5·49—5·60 hydrogen, and further showed that it is a glucoside, splitting up, when boiled with dilute sulphuric acid, into

* Adams considers πετροσέλινον to be the Stone Parsley, *Petroselinum macedonicum*, still cultivated in Europe.

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glucose and *Apigenin* (66·13 per cent. C. 3·9 H.). From these numbers Lindenborn inferred that apigenen is isomeric with quinone, and assigned to apiin the formula $C^{12}H^{14}O^{7}$, representing its decomposition by the equation, $C^{12}H^{14}O^{7}+H^{2}O = C^{6}H^{4}O^{2}+C^{6}H^{12}O^{6}$. Quite recently apiin has been further examined by E. v. Gerichten (*Deut. Chem. Ges.Ber.* IX., 1121), whose results agree in the main with those of Lindenborn, his analysis of apiin giving 53·55 per cent. C., 5·36 H., and that of apigenin 65·12—66·21 C., and 3·75 —3·91 H.

Apiin is slightly soluble in cold, easily in hot water, still more easily in hot alcohol, insoluble in ether; from the aqueous or alcoholic solution, it always separates by slow cooling in the form of a jelly. It dissolves in alkalies with a light yellow colour. Its hot aqueous solution gives no precipitate with silver nitrate, lead nitrate, or copper sulphate, a brown-red precipitate with ferric chloride, a blood-red coloration with ferrous sulphate. Apiin is powerfully dextrogyrate, its specific rotatory power for yellow light being + 173°. (*Gmelin's Handb.* 16, 94; *Watts' Dict. of Chem.* VIII., Pt. I., 117.) The seeds and herb yield a colourless or pale yellow essential oil, sp. gr. 0·881. *Apiol* or Parsley camphor, which has lately been obtained from parsley seeds, is also found in those of Celery.

Commerce.—Value, Rs. 6 per Surat maund of 37½ lbs.

FŒNICULUM VULGARE, *Gärtn.*

Fig.—*Bentl. and Trim.*, *t.* 123. Fennel (*Eng.*), Fenouil (*Fr.*).

Hab.—Cultivated in India. The fruit and root.

Vernacular.—Bari saunf (*Hind.*), Panmohuri (*Beng.*), Wariárí (*Guz.*), Bari-shopha (*Mar.*), Shombu (*Tam.*), Sopu (*Tel.*), Somp (*Can.*).

History, Uses, &c.—Fennel is identified by Mahometan writers as the μάραθον of the Greeks, who also called it μάραθρον. It is mentioned by Hippocrates and Dioscorides as a diuretic and emmenagogue, and the juice was supposed to sharpen the eyesight. Nicander and Pliny mention certain superstitious

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notions concerning fennel, which are expressed in the following lines by Macer Floridus (*De Vir. Herb.*):—

Cum vino cunctis obstat hæc herba venenis;
Hac morsa, serpens oculos caligine purgat,
Indeque compertum est humanis posse mederi
Illam luminibus, atque experiendo probatum—
Urinas purgat et menstrua sumpta resolvit,
Vel si trita super pecten hæc herba ligetur—
Tradunt auctores *ejus juvenescere gustu.*
Serpentes, et ob hoc *senibus prodesse putatur.*

Indian Sweet Fennel is rather smaller and straighter than the European article, but in other respects is similar to it. Fennel fruit is used by the natives of India as a condiment and as an aromatic adjunct to medicines. A distilled water, known as Ark-i-bádián, is prepared from it. The Sanskrit name is Madhurika (sweet). As pointed out by Mr. M. Sheriff in his Appendix to the *Pharmacopœia of India*, this plant and the anise are often confounded in Arabic and Persian works on Materia Medica. The Persians call the fruits of both Razianah, but the Hindu dealers in Bombay call Fennel Wariarí and Anise Erva-dos. The root of fennel is rather an important medicine in native practice, being to the present day esteemed as one of the five opening roots of the ancients.*

Description.—The fruits are oblong, cylindrical, about 3-10ths of an inch long and 1-10th in diameter, nearly straight, terminating with the two-pointed base of the style and smooth on the surface. Each mericarp has five prominent ridges. Between the ridges are vittæ, and there are two on the commissural surface. The colour of the fruit is a pale greenish yellow, the odour like that of anise, and the taste sweet and aromatic.

Chemical composition.—Fennel fruit yields about 3 per cent. of volatile oil, which consists of *anethol* or anise camphor, $C^{10}H^{12}O$, and variable proportions of a liquid isomeric with

* The five opening roots are Fennel, Parsley, Wild Celery, Asparagus and Butcher's Broom (*Ruscus aculeatus*). The wild bitter Fennel is probably the μαραθρον of Dioscorides (iii., 74) and of Theophrastus, H. P. i. 18, 19, vi. 1 2; vii. 3).

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oil of turpentine. Anethol is obtainable from fennel in two forms, the solid and the liquid; crystals of the former are deposited when the oil is subjected to a somewhat low temperature; the liquid anethol may be got by collecting the portion of the crude oil passing over at 225° C. The crystals of anethol fuse between 16 and 20° C., the liquid form of anethol remains fluid even at —10° C. By long keeping the crystals slowly become liquid, and lose their power of reassuming the crystalline form. (*Pharmacographia.*) Wernecke found 7·25 per cent. of ash in the fruit.

Commerce.—Fennel is largely cultivated on the table lands of India. The fruit sells for Rs. 3 to 4 per Surat maund of 37½ lbs. The exports from Bombay in 1881-82 were 2,201 cwts., valued at Rs. 16,630; only 5 cwts. went to the United Kingdom, and the rest to Eastern ports.

PEUCEDANUM GRANDE, *C. B. Clarke.*

Hab.—Hills of Western India. The fruit.

Vernacular.—Dúkú (*Hind., Bomb.*), Báphali (*Mar.*).

History, Uses, &c.—The fruit of this plant has been adopted in India as a substitute for the Daucus seeds of the ancients, which were obtained from a species of Athamanta growing in Crete. This adoption was probably due to the early visits of Greek travellers and traders to Thana, and to the subsequent resort to the same port of the Mahometans early in the 14th century. The plant is common on the hills of the Concan, and was probably brought for sale to Thana in those days, as it still is at the present time. In Royles' Materia Medica, Falconer is quoted as describing Dúkú as a fruit resembling that of Asafetida, and as probably derived from some species of Ferula; this is just such a fruit. Dúkú was justly considered by the ancients as carminative, stimulant, and diuretic. Other umbelliferous fruits are not unfrequently substituted for this drug. We have received those of *Dorema Ammoniacum* from Bengal, and those of an Asafetida plant from Northern India. Haji Zein under the name of هرمج

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(marmaj) mentions an Indian seed having the appearance and properties of Daucus.

Description.—Plant three to seven feet high, having very much the appearance of a garden parsnip which has run to seed; root large, perennial, all quite smooth; leaves mostly radical, long-petioled, bipinnate; leaflets trilobate; lobes large, rounded; margins crenate serrate, shining on both sides; cauline leaves 1 to 2, biternate; stem round, smooth, striated, involucre and involucel leaves oblong or obovate, obtuse, partial rays numerous, many flowered; flowers yellow; fruit large, broadly elliptical, varying in size, the largest are $\frac{5}{8}$ of an inch long and $\frac{3}{8}$ broad; foliaceous, convex in the middle, with a dilated border, consisting of coarse cellular tissue; colour reddish yellow over the seed, margin pale yellow; dorsal ridges seven, the three central filiform; vittæ in dorsal furrows ten to thirteen; vittæ of commissure six. The fruit has a powerful lemon odour with a *soupçon* of carrot.

Chemical composition.—Twenty-five pounds of the fruit distilled with water yielded 6 fluid ounces of a light yellow essential oil having the odour of the fruit; it was dextrogyre, a column of 100 m. m. rotating 36 degrees. The specific gravity at 15°·5 C. was ·9008. Cooled to —14° C. it was still liquid and no crystals separated. After dehydration the oil commenced to boil at 76° C., the temperature rapidly rose to 100° C., when a few drops distilled over; the temperature continued to rise rapidly to 185° C., up to this temperature 2 per cent. distilled over. The subsequent progress of the distillation may be tabulated as follows :—

2nd fraction	...... 185° to 190°	 17	per cent.
3rd „	...... 191° to 196°	 15	„
4th „	...... 196° to 200°	...... 12·5	„
5th „	...... 200° to 205°	...... 9·6	„
6th „	...... 206° to 210°	...... 6·4	„
7th „	...... 210° to 220°	...... 4·5	„
8th „	...... 220° to 225°	...... 4·0	„
9th „	...... 226° to 228°	...... 3·0	„

The residue left in the flask boiled constantly at the last recorded temperature and amounted to 26 per cent. The

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fractions up to the 6th were colourless, those below of a yellow colour. The residue in the flask was viscid and of a deep yellow tint. Treated with reagents the oil in its original state afforded the following reactions:—Bromine dissolved in chloroform, at first nearly colourless, turning to dirty brown with a tinge of red, and finally to a dirty sage green. Concentrated sulphuric acid, deep orange to red. Frohde's reagent, yellow, deep brown, violet to deep blue, the changes in colour being extremely rapid. Nitric acid gave a yellow coloration. Picric acid dissolved in the oil. With solid iodine much heat was evolved. Gaseous hydrochloric acid was passed into the oil for some time, but on cooling the liquid no crystalline deposit separated. A slight precipitate of silver was produced from an ammoniacal solution of the nitrate.

Commerce.—The fruit is worth about Rs. 6 per pharrah (about 25 lbs.).

PEUCEDANUM GRAVEOLENS, *Benth.*

Fig.—*Bentl. and Trim., t.* 132. Dill, (*Eng.*), Aneth, Fenouil puant (*Fr.*)

Hab.—Cultivated in India. The fruit.

Vernacular.—Sowa (*Hind.*), (Shepu *Mar.*), Shoyikirai-virai, Shatakuppi-virai (*Tam.*), Shatakuppi-vittulu (*Tel.*), Sabbasagi (*Can.*), Shonva (*Beng.*), Suva (*Guz.*).

History, Uses, &c.—Dill seed is much esteemed by the natives of India, who use it as a condiment and medicine. An infusion of it is given as a cordial drink to women after confinement. The leaves moistened with oil are used as a stimulating poultice or suppurative. The Sanskrit names are Misreyá and Shatapushpa. Mahometan writers describe Shibbit as resolvent and deobstruent, carminative, diuretic, and emmenagogue. The Persian name is Shúd and the Yunáni Anitun.*

* Compare with Dioscorides περὶ ανηθου (iii., 60). Pliny (20, 74). Hippocrates περί διαιτης (ii., 25). Many Greek writers speak of Anethon and Anison as one and the same plant, but Alexis Λέβ. 2, 7, distinguishes them.

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Description.—The fruits of the Indian plant, which has by some been called *Anethum Sowa*, do not differ in any important respect from those of the European plant. The mericarps are somewhat narrower and more convex, the ridges more distinct, and the border less winged.

Chemical composition.—Dill fruits yield from 3 to 4 per cent. of an essential oil, a large proportion of which was found by Gladstone (1864-72) to be a hydrocarbon, $C^{10}H^{16}$, to which he gave the name *Anethene*. This substance has a lemon-like odour, sp. gr. 0·846, and boils at 172° C. It deviates a ray of polarized light strongly to the right. Nietzki (1874) ascertained that there is, moreover, present another hydrocarbon, $C^{10}H^{16}$, in a very small proportion, which boils at 155 to 160°. A third constituent of oil of Dill is in all probability identical with carvol. (*Pharmacographia*, 2nd Ed., p. 328.)

Commerce.—Suva is cultivated throughout tropical and sub-tropical India in the cold season. Value, Rs. 3⅜ per pharrah (about 35 lbs.).

CORIANDRUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 133. Coriander (*Eng.*), Coriandre (*Fr.*).

Hab.—Cultivated in India. The fruit.

Vernacular.—Dhanya (*Hind.*), Dhanya, Dhana (*Mar.*, *Guz.*), Kotamalli (*Tam.*), Danyalu (*Tel.*), Kottumbari (*Can.*).

History, Uses, &c.—The Coriander plant is called Kothmir, a name derived from the Sanskrit Kusthumbari; when young it is much used in preparing chutneys and sauces. The fruits are largely used by natives as a condiment; as a medicine they are considered carminative, diuretic, tonic, and aphrodisiac, and are often prescribed in dyspepsia. A cooling drink is prepared from them pounded with fennel fruit, poppy seeds, Kanchan flowers, rosebuds, cardamoms, cubebs, almonds and a little black pepper; it is sweetened with sugar. Mahometan writers describe them as sedative, pectoral and carmi-

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native; they prepare an eyewash from them which is supposed to prevent small-pox from destroying the sight, and to be useful in chronic conjunctivitis. Coriander is also thought to lessen the intoxicating effects of spirituous preparations, and with Barley meal to form a useful poultice for indolent swellings. It is the Kuzbura of the Arabs and Kishníz of the Persians, who identify it with the Koriyun of the Greeks.* The opinion that it has great cooling properties prevailed amongst Western physicians, "coriandrum siccum frangit coitum, et erectionem virgæ impedit." Apuleius says it assists women in child-birth and protects them from fever. The following is an example of a cooling confection of the time of Charles the First:—R. Seminis Lactucæ, Portulacæ. Coriandri ana ana ʒi. Menth. siccæ ʒss, Sacchari alb. ℥iv. Pulverisentur omnia subtiliter, et post ea simul misce aqua nenupharis, f. confectis solida in morsulis, ex his sumat mane unum quum surgat.

Description.—Indian Coriander is much larger than that grown in Europe, and of an ovoid form; it consists of two mericarps firmly joined together, they are crowned by the stylopodium and calicinal teeth. Hanbury and Flückiger have the following excellent description of the fruit:—"The pericarp bears on each half four perfectly straight sharpish ridges, regarded as secondary (juga secundaria); two other ridges often of darker colour, belonging to the mericarps in common, the separation of which takes place in a rather sinuous line. The shallow depression between each pair of these straight ridges is occupied by a zigzag raised line (jugum primarium), of which there are therefore 5 in each mericarp. It will thus be seen that each mericarp has five (zigzag) so-called primary ridges, and four (keeled and more prominent) secondary, besides the lateral ridges, which mark the suture or line of separation. There are no vittæ on the outer surface of the pericarp. Of the five teeth of the calyx, two often grow into

* Confer. Dios. περι κορίου, iii., 64. Theophr. H. P. (κόριαννον), vii., 1, 3, 4, 6. Pliny, 20, 82.

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long pointed, persistent lobes; they proceed from the outer flowers of the umbel. Though the two mericarps are closely united, they adhere only by the thin pericarp, enclosing when ripe a lenticular cavity. On each side of this cavity, the skin of the fruit separates from that of the seed, displaying the two brown vittæ of each mericarp. In transverse section, the albumen appears crescent-shaped, the concave side being towards the cavity. The carpophore stands in the middle of the latter as a column, connected with the pericarp only at the top and bottom."

Chemical composition.—The essential oil is isomeric with borneol, formula $C^{10}H^{18}O$. According to Kawalier, if the elements of water are extracted by phosphoric anhydride, it is converted into an oil of offensive odour, formula $C^{10}H^{16}$.

The fruits yield from 0·7 to 1·1 per cent. of volatile oil and 13 per cent. of fixed oil.

Flückiger obtained from the green herb from 0·57 to 1·1 per mille of an oil having an offensive odour, which deviated the ray of polarized light 1·1° to the right when examined in a column of 50 mm. long. The oil distilled by him from ripe fruit deviated 5·1° to the right.

Warnecke has found in Coriander fruit 5·21 per cent. of ash.

Commerce.— Coriander is cultivated throughout tropical and sub-tropical India; it is worth about Rs. 3 per pharrah (about 35 lbs.). It is largely exported to eastern ports.

PIMPINELLA ANISUM, *Linn.*

Fig.— *Bentl. and Trim., t.* 122. Anise (*Eng.*), Anis (*Fr.*).

Hab.—Persia, Europe, cultivated. The fruit.

Vernacular.—Erva-dos (*Bomb.*). The Indian names for Anise are the same as those for Dill.

History, Uses, &c.—Anise does not appear to have been known to the ancient Hindus, and is not mentioned in Sanskrit works. It was introduced into India by the Maho-

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metans from Persia, whence the supply for the Bombay market still comes. Anise is now grown in Northern India.

The natives use anise in the same way as we do. The Persians call it Ráziánah, which the Arabs corrupt into Razianaj. They identify it with the Anisum of the Greeks,* and the Mahometan druggists of India know it by this name. The Bombay name, Ervados, is a corruption of the Portuguese 'Herba doce.' M. Sheriff states that the seeds of *Carum Roxburghianum* are sold in Southern India as Anisum.

Description.—The fruit varies a good deal in size; if well grown it should be about 2-10th of an inch long. The mericarps often adhere together with the pedicel attached, forming an ovoid body crowned by a pair of styles. Each fruit has 10 ridges, and is covered with short hairs. The taste is remarkably sweet and aromatic. The vittæ, which contain the essential oil, are very numerous, each mericarp being provided with about fifteen.

Chemical composition.—The fruit yields from 2 to 3 per cent. of essential oil, which is a colourless liquid, but after a time becomes yellow. It has the taste and odour of the fruit, sp. gr. 0·977 to 0·983. At from 10 to 15° C. it becomes a crystalline mass. Oil of anise resembles oil of fennel (*vide* Fennel) in that it consists almost entirely of anethol. Warnecke found 6·70 per cent. of ash in the fruit.

Commerce.—Anise is imported from Persia. Value, Rs. 5 to Rs. 6 per Surat maund of 37½ lbs.

ANTHRISCUS CEREFOLIUM, *Hoffm.*

Fig.—*Eng. Bot.*, 1268; *Jacq. Aust.*, 390. Chervil (*Eng.*) Cerfeuil (*Fr.*).

Hab.—Europe. Cultivated elsewhere.

Vernacular.—Atrilál (*Ind. Bazars*).

History, Uses, &c.—One of the oldest of cultivated potherbs. It is mentioned by Aristophanes, who wrote about

* Comp. Dios, περὶ ανὶσου, iii., 58, and Plin. 20, 72, 73.

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430 B.C., as a herb sold by the greengrocers. In his Acharnes (line 478) he has σκάνδικά μοι δὸς, μητρόθεν δεδεγμένος in allusion to the mother of Euripedes being a seller of Chervil. Theophrastus and Diocorides were well acquainted with it, and describe it as diuretic, stomachic and deobstruent. Pliny (22, 38,) speaks of Scandix and Anthriscum as nearly the same plants,—the latter appears to have been the cultivated chervil—he says:—"Its principal virtue is that it re-invigorates the body when exhausted by sexual excesses, and acts as a stimulant upon the enfeebled powers of old age." Ibn Sina calls it Rijl-el-ghuráb, and says that Paulus and others have recommended it in colic. Haji Zein-el-Attar (A.D. 1368) has the following account of Atrilál; "There are two kinds of seed, dark and light-coloured like celery seed in size, and cumin in shape, very bitter. The light coloured is the largest, and is the kind called Khilal-i-Khalil in Persian; this is true Atrilál, different from the Egyptian: it grows at Ahwaz. The Egyptian kind is also called Rijl-el-tair, Rijl-el-ghuráb, and Harj-es-shayatin "devil's bane". Atrilál is useful in white leprosy and tetter. One dirham alone, or with one dang of Pyrethrum, is rubbed down with honey and administered; the patient then sits in the sun until he sweats; this causes the formation of blisters and the discharge of yellow serum from the affected part, and the skin recovers its natural colour. The powdered seeds used as a snuff cause abortion." In the Madd-el-kámus, Lane has the following summary from Arabian authorities:—Rijl-el-ghuráb signifies a certain herb called, in the language of the Barbar, Itrilál, and in the present day Zir-el-ákileh, resembling the *Shibith* in its stem and in its *jummeh* (or node whence the flower grows) and in its lower part, or root, except that its flower is white, and it forms grains nearly like those of Makdúnis (parsley). A dirham of its seeds, bruised and mixed with honey, is a tried remedy for eradicating the برص (white leprosy) and the بهق (tetter) being drunk,—and sometimes is added to it a quarter of a dirham of pellitory,—the patient sitting in a hot sun, with the diseased part uncovered. In Bocthor's Dict. Français-Arabe, the names Rijl-el-ghuráb and

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Atrilál are given to Chervil and Buckshorn plantain (*Plantago coronopus*).

Chervil has been cultivated in England since A.D. 1590, and has run wild in some parts of the country; it is much used on the continent of Europe as a pot-herb. *A. sylvestris*, or wild Chervil, is said to be poisonous; it has an acrid bitter taste.

Description.—Fruits lanceolate, laterally compressed, almost cylindrical, black, smooth, terminating in a short 5-angled beak, crowned with the depressed wavy receptacle of the flower. Taste aromatic, free from bitterness.

Commerce.—In the Indian bazars the fruit of *Vernonia anthelmintica* is generally supplied for Atrilál by Mahometan druggists; the genuine article is hardly ever obtainable.

DAUCUS CAROTA, *Linn.*

Fig.—*Wight Ill., t.* 117, *fig.* 7.

Hab.—Cashmere, Western Himalaya. Cultivated throughout India.

Vernacular.—Gájar (*Hind., Guz., Mar., Beng.*), Gájjara-kelangu, Manjal-mutlangi (*Tam.*), Gájjara-gadda, Pita-kanda (*Tel.*)

History, Uses, &c.—The wild carrot is a native of temperate climates, and in the Himalaya grows to the height of six feet. It is called in Sanskrit *Garjara*, and has probably been in cultivation in India from a very remote period. There is a custom amongst the Hindu women of presenting trays containing carrots or radishes along with different kinds of fruit, green gram (*Cicer arietinum*) and sweetmeats, especially those made from Sesamum seeds, at the festival of *Makar Sankránti*, when the sun is worshipped upon his entry into the sign of Makar (Capricorn). These offerings are made upon the second day of the festival, which is called Kar, to friends and relations. In the temple of Apollo at Delphi, radishes were offered upon golden plates as typical of nutriment, and the Indian offering appears to have the same meaning. The

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Greeks cultivated the carrot (σταφυλίνος) and also the Romans who called it *Pastinaca erratica*. It is clearly described by Dioscorides, and his commentator Marcellus Vergilius remarks that Pliny says "Est et quartum genus in eadem similitudine pastinacæ nascens, quam nostri Gallicam vocant, Græci vero daucon." From this we may conclude that the Daucus was like the pastinaca erratica or carrot, but not the same plant. The carrot was also called by the Greeks κέρας from its similarity to a horn; in the old Greek lexicons we read "σταφυλίνος ἄγριος ὅν ἔνιοι κέρας καλοῦσι". The Daucus of the Greeks, according to Dioscorides, was of three kinds, the best or Cretan kind had acrid, white, hairy, odoriferous fruit; the second kind was a plant like Celery, with a pungent taste and aromatic odour; and the third kind had an acrid fruit, having the appearance of Cumin. The first kind is generally considered to have been a species of *Athamanta* growing in Crete. Of the third kind, Gronovius says:—" Daucus tertius Dioscoridis, incolis Zarneb, Melchi, Rauwolf. Hodoep., Pt. I. c. 9, p. 116 et Pt. II., c. 2, p.146. Seseli Cretense nodosum umbella lutea, Moris. Hist. iii., p. 287, f. 9." (*See Trachydium.*) Apicius, a writer on cookery, about A. D. 230, mentions an edible root called *Carota*, which no doubt was the same as our Carrot; as is also the Gazar of the Persians and the Jazar of the Arabians, which they do not identify with the Daucus of Dioscorides, but with his Staphylinos. The old writers on Materia Medica describe Carrots as hot in the extreme of the second degree, moist in the first, diuretic, laxative, emollient, strengthening the venereal faculty, emmenagogue and antiseptic. A decoction of carrots was long a popular remedy for jaundice in Europe, and the dried peduncle is a favourite toothpick among the Arabs on account of its aroma. In India, the seeds are popularly supposed to cause abortion, and are kept by all the native druggists. In those parts of the country where the root is cultivated, it is used with salt as an antiseptic poultice. In modern medicine the carrot poultice has been superseded by more powerful antiseptics, but the fruits still hold a place among our stimulant diuretics, the action being apparently

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due to the volatile oil which they contain, acting locally upon the vessels or nervous structures of the kidney, during its excretion.

Description.—Fruit somewhat compressed from the back, ovate or oblong; mericarps with the five primary ridges filiform and bristly, the three middle ones at the back; the two lateral on the plane of the commissure; the four secondary ridges equal, more prominent, winged, split into a simple row of spines; channels beneath the secondary ridges vittate. Seed anteriorly flattish. (*Pereira.*)

Chemical composition—The chief constituents of carrot root are carotin, hydrocarotin, oil, sugar, pectin, nitrogen compounds and a little volatile oil. Carotin is a crystalline ruby-red, tasteless, neutral substance, said to be probably formed by oxidation from hydrocarotin, which is a colourless substance. Landsberg describes the essential oil of the fruit as pure yellow, of an agreeable carrot odour and acrid taste; sp. gr. at 20° C., 0·8829. It is levogyre, free from sulphur or nitrogen, and acid in reaction from the presence of acetic acid. The two principal constituents are a terpene belonging to Wallach's pinene group, and an oxygenated body ($C^{10}H^{18}O$) standing in near relation to cineol (eucalyptol).

TRACHYDIUM LEHMANNI, *Benth. et Hook. f.*

Fig.—*Trans. Linn. Soc.* 2 *Ser. Bot., Vol. iii., Pt.* I., *pl.* 11.

Hab.—Persia.

Vernacular.—Shekákul (*Pers., Indian bazars*).

History, Uses, &c.—Shekákul or Sháshkákul, now spelt with the Arabian *káf*, is a Persian word. It is explained in the Burhán as the wild carrot root, the touch of which is supposed to cause a pregnant woman to abort. Haji Zein-el-attàr says that the plant is called *Kirs-giyah* "bear's wort" in Persian, and a kind of it at Shiráz *Badrán*; he describes the foliage as like that of anise or fennel, and says that the flower is yellow and pubescent. Ibn Sina mentions Shekákul as an

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aphrodisiac, but gives no description of it. Other Arabian physicians give a similar account of it, and quote Dioscorides as an authority for its use in dropsy as a diuretic (cf. Diosc. *sub-voce* καυκαλις). The Mahometans identify the drug with the Caucalis of Theophrastus, Dioscorides, Galen, Nicander and Oribasius; the best is said to be that which comes from Egypt, and is heavy and of a yellowish-brown colour. Theophrastus classes caucalis among the ἀρουραιον or weeds of cultivation, and Galen says that it has the same taste and properties as Daucus. Pliny notices it as an edible plant, and attributes to it a number of properties not mentioned by the earlier Greek writers. Gronovius in his *Flora Orientalis* has the following notice of Shekákul:—"Tordylium orientale, Secacul Mauris, Rauwolf. Hodoep. Pt. iv., t. 13. Sisarum Syriacum, Bauh. Pin. 155. Apium Syriacum radice ampla eduli, Moris. Hist. iii., p. 292. Secacul Arabum, Pastinaca Syriaca, Germanis gerelen, sive Sisarum species. Dalech App. 23. Ic., p. 24. Cresit juxta sepes et hortos urbis Halepi, locis præsertim apricis et sub arboribus." Sheik Dáwood of Antioch describes shekakul as like a small carrot and of a sweetish taste; he says we call the plant حرض النيل (Hard-un-nil). It would appear that in Western countries at least two species of Tordylium, one growing in Syria (*cf. Jacq. Vind.* 1, *t.* 54) and one in the Levant (*cf. Cam. Hort.* 37, *t.* 11,) have been used as shekákul, but whether either of these plants was the caucalis of the Greeks it is impossible to say. In Persia, *Trachydium Lehmanni,* a very nearly allied plant, produces the shekakul of Asia. Aitchison, when travelling in the Badghis district with the Afghan Boundary Commission, observed the roots of this plant being collected for export to India as shekákul.

Description.—A root of the shape and size of a small carrot, with a conical leaf-bud rising from the crown; externally it is wrinkled and longitudinally furrowed, and is of a light brown colour; internally it is white, starchy and friable; taste amylaceous and sweetish.

Buzidan.—*Caucalis orientalis,* the βουσαιδαν and μπουσαιταν of the later Greek physicians, is closely allied to Shekakul, and is con-

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sidered by Haji Zein-el-attar to be the καυκαλις of Galen. After a discussion in which he says that the true drug comes from Egypt, he concludes by saying that women call this drug and Shekákul, *Shirza* (*shir* milk, and *za* begetting). A drug considered by some to be identical with *buzidán*, and by others to be only similar to it, is called by the Arabs Mustaajil and Uruk-el-bid (hen's root), and an English name for *Caucalis daucoides* is hen's claw. For further information concerning Buzidán, see *Tanacetum*. Another kind of Shekákul is occasionally met with in India; it is a shrivelled rhizome of a light brown colour, marked with transverse scars like Galangal, the taste is sweet and gummy; when soaked in water it swells greatly, becomes quite soft, and is easily cut like preserved ginger. The drug comes from China.

PRANGOS PABULARIA, *Lindl.*

Fig.—*Wall. Pl. As. Rar. ii.*, 7, *t.* 212.

Hab.—Thibet, Cashmere.

Vernacular.—Prangos (*Thib.*), Komal (*Hind.*), Fiturasaliyun (*Indian Bazars*), Badián-i-kohi (*Afghan.*).

History, Uses, &c.—Sanskrit writers mention a plant called Komal and Avi-priya, or "dear to sheep," which is probably *P. pabularia*. In the first quarter of the present century this plant created considerable interest in England. Mr. William Moorcroft, a veterinary surgeon of the Bengal Army, had heard that it was an important factor as a food for cattle, and was occasionally used as a medicine. When on an expedition in 1822 to Upper Assam, for the purpose of opening trade relations with the Chinese authorities at Ela, he made an excursion to Draz, in order to collect specimens of the plant and to study its use as a fodder plant by the natives. The plant which hitherto had been unknown to botanists, was sent to the Director of the Horticultural Society of London as deserving special attention as a fodder plant of particular value, well worthy to be cultivated in England and her colonies for the following reasons:—In its native country the dried plant

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is used as a winter fodder for sheep and goats; it is described as being heating and fat producing, besides being a reliable remedy against the dangerous *Fasciola hepatica*, which often causes the death of thousands of sheep, especially after a wet autumn. Mr. Moorcroft drew special attention to the fact that the plant possessed a remarkable vital force, and thrived well in very poor soil without requiring culture or manure.

Only one bad quality was ascribed to it, *viz.*, its having been observed that horses fed on its fruit suffered frequently from inflammation of the eyes and were sometimes subject to temporary blindness. Its cultivation was then tried in various colonies, especially at the Cape, but it seems that the great advantages expected from it were not realised, for no later information is available.

As a medicine Prangos commands a certain amount of interest, its fruit being sold by Mahometan druggists in India under the name of Fiturasaliyun as a substitute for the Petroselinon or Rock parsley of the Greeks, and Karafs-el-jibali of the Arabs, a plant which has not been identified, and which is described by Dioscorides as having fruit like Ammi, and as being carminative, diuretic and emmenagogue.

The late Dr. Royle was of opinion that Prangos was probably the kind of Silphium mentioned by Arrian, the historian of the campaigns of Alexander the Great, who records that in the part of the Caucasian mountains which corresponds to the present Hindu Kush, only pines and silphium grow, and as the country is inhabited by a numerous people keeping large flocks of sheep the silphium acquires great importance. Its smell attracts the animals from afar—they feed on the flowers and also dig up the roots and eat them. Of the root, which measures from 18 to 22 inches in length, a fine illustration will be found in Wallich. It must not, however, be forgotten that *Ferula ovina*, Boiss., is greedily depastured by sheep, and may have been the silphium of Arrian.

Description.—The fruit consists of a pair of mericarps about ¼ inch long, which together form an elongated oblong

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body crowned by the stylopodium and calycinal teeth; each mericarp has five very prominent convoluted ridges, and measures 5·8 m.m. in length, and 3·4 m.m. in breadth, the colour is a dirty yellow; under pressure the fruit separates into two halves which remain attached to the carpophore. Secondary ribs are not present. Under the microscope a transverse section of the mericarp shows five large irregularly formed ribs traversed by as many bundles of vessels, two more bundles are to be found on each side of the narrow uneven fissure surface. The rest of the tissue consists of parenchyme cells. The pericarp incloses the seed, which is surrounded by many, large, oval-shaped oil vessels, about 40 in number. This cell-line bends itself on both sides towards the interior, thus giving the seed the appearance of a horseshoe. The oil vessels are filled with a yellowish-brown oil, having an odour of caraways. The endosperm consists of a series of rows of many-sided cells, containing a fatty oil and grains of aleurone; it surrounds the embryo, which is dark brown and rather large. Starch is not present. (*H. Lojander Archiv. d. Pharm.* 1887.)

Chemical composition.—An examination of the air-dried fruit resulted in the detection of the following constituents:—

An essential oil.
Traces of fixed oil.
Resins.
Traces of an alkaloid.
Quercitrin in large amount.
An ethereal salt of valeric acid.

Sixty pounds of the fruit were distilled with water in two portions, the water from the distillate of the first distillation being used with the second portion of fruit. The oil was almost entirely soluble in the water of the distillate, and had to be separated by shaking with ether. The yield was very small, about half an ounce. The ethereal oil recalled both the odour of menthol and xanthoxylon oil with an after odour of caraways; it was a mixture of more than one oil, but the amount at our disposal was not sufficient to admit of thorough fractional distillation: it was lighter than water, and after distillation

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with water, the colour was slightly yellow. With reagents it afforded the following colour reactions:—Bromine dissolved in chloroform deep dirty red; alcoholic hydrochloric acid yellow; concentrated sulphuric acid deep orange red; concentrated nitric acid deep red. Treated with solid iodine some heat was developed, but no marked reaction, the iodine freely dissolved; with Fröhde's reagent a deep red was produced, rapidly changing to deep blue. Sulphuric acid and ferric chloride gave a dirty red. Picric acid dissolved in the oil easily in the cold. No crystals separated on cooling to 1°·5 C. The alkaloid afforded marked precipitates with alkaloidal reagents:—concentrated nitric acid yellow; sulphuric acid brown: no reaction with ferric chloride. An alcoholic extract was agitated with ether, and after driving off the ether, the ethereal extract was heated with caustic soda, when an odour was developed very similar to that of otto of roses.

FERULA ALLIACEA, *Boiss.*

Hab.—Persia. The gum-resin.

Vernacular.—Hing (*Hind.*, *Beng.*), Káyam, Perun-gáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*), Vagárni, Hing (*Guz.*).

History, Uses, &c.—The old Greek and Latin writers on Materia Medica mention two kinds of *Silphium*—one good or sweet, and the other fetid. Theophrastus in his History of Plants (vi., 8), speaks of two varieties, *of the stem* and *of the root.* He says: *ὀπόν δὲ διττὸν ἔχει, τὸν μὲν ἀπο τοῦ καυλοῦ τὸν δέ ἀπὸ τῆς ῥιζης, δί δ' καλοῦσι τὸν μὲν καυλίαν τὸν δε ῥιζιαν.* Dioscorides mentions two kinds, one coming from Cyrene and the other from Asia. Some consider the silphium of Cyrene to have been entirely different from our Asafœtida, but from a passage in Strabo this does not appear to have been the case. He says:—*ὁ Μηδικὸς καλόυμενος, ὀπὸς ὀυ πολὺ λειπὸμενος του Κυρηναικου.* Pliny's account of silphium or laserpitium is very confused, but he has collected some information which we now know to be correct. N. Myrepsicus appears to be the first writer who mentions the name *ἀσαφίτιδα*, which he says is an Italian name for the *σκορδολάσαρον*

of the Greeks of his day. In the Rudens of Plautus (B. C. 220) the scene of which is near Cyrene, frequent allusion is made to the growth of Laserpitium there, and the preparation and export of the gum-resin, as forming the staple article of trade. The Greek and Latin authors agree in saying that the silphium or laser of Cyrene was the best, but from the works of Pliny and Scribonius Largus we learn that it was almost if not quite unobtainable in their time. Pliny relates that a single plant was presented to the Emperor Nero as a curiosity. The gum resin of *F. alliacea* is the Hing of the natives of India, the other kind being seldom used by them. In Sanskrit it is called Hingu, and is said to be so called from its killing or overpowering all other odours. In the Nighantas it bears various synonyms, amongst which may be mentioned Balhika, "coming from Balkh"; Rámatha, Bhúta-násana, "destroying demons"; and Sula-násana, "removing pain in the stomach"; it is described as hot, digestive, appetizing, pungent; a remedy for phlegm, rheumatism, griping, flatulence, diseases of the belly, satiety and worms. It increases the secretion of bile.

Hindu medical writers direct it to be fried before being used. It is in great repute as a condiment among vegetarians, also as an antispasmodic in nervous affections; taken daily it is thought to ward off attacks of malarial fever.

Asafœtida must have been used in India from a very remote period, as the earliest Sanskrit writers mention it.

The plant is called Jatuka on Játuka, a word derived from Jatu, "gum or lac"; it is described as a fragrant plant. Of the Mahometan writers on Materia Medica, Ibn Sina mentions two kinds of Asafœtida—*tyib* (good) and *muntin* (fetid), but gives no description of them. Ali Istakhri, who also lived in the 10th century, states that the drug is produced abundantly in the desert between Sistan and Makran, and is much used by the people as a condiment. The geographer Edrisi, who wrote about the middle of the 12th century, asserts that Asafœtida, called in Arabic Hiltit, is collected largely in Western Afghanistan. Haji Zein the druggist, in the 14th

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century, tells us that the two kinds of Asafœtida are produced by two different plants, the black and the white *Anjudán*, and that the later plant produces the kind known as *tyib* (good). Mir Muhammad Mumin of Shiraz, who wrote in the 17th century, remarks that the Asafœtida known as *tyib* has a reddish colour, and is produced by a plant vulgarly known as Kulah-par (cap-leaf), that known as *muntin* has a disagreeable odour like a leek, and is called at Ispahan Angusht-gandah, "stink finger." Aitchison, who travelled in Eastern Persia, and the neighbouring districts of Beluchistan and Afghanistan, with the Afghan Boundary Delimitation Commission (1884—85) found that the name *Kema* (کما) was applied generally by the peasantry to the large umbelliferous plants in those parts, the Asafœtida plant being distinguished as Anghuzah-kema and the Ammoniacum as Kandal-kema. The primary meaning of this word in Persian is a sleeve, and there can be no doubt that the similarity between the large sheathing petioles of these plants, and the loose Persian sleeve has suggested the comparison. It would appear then that the kind of Asafœtida called *tyib* by the Arabs and their followers is the drug of European commerce, the produce of *Ferula fœtida*, Regel, and not that of *F. alliacea*, Boiss., which produces the Hing of India. In describing the medicinal properties of the drug, the Mahometan physicians closely follow Dioscorides.

The flowering stems of the Asafœtida plants are eaten as a vegetable, as stated by Pliny. Aitchison notices their use for this purpose, and Dr. Peters forwarded to one of us the flowering stem of *F. fœtida*, Regel, which he had purchased in the bazar at Quetta.

Guibourt (1850) was the first European writer to point out the difference between the Asafœtida of India known as *Hing* and that of the European Pharmacopœias which is called in India *Hingra*. Vigier, *Gommes-résines des Ombellifères* (1869) calls *Hing* Asafœtida nauséeuse. We are indebted to Mr. Ardeshir Mehrban, a merchant of Yezd, for most of the following particulars regarding the source of this drug. Mr.

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Ardeshir, having himself visited the hills where the plant grows, was able to speak from personal observation. The plant which produces the Asafœtida used in India (Darakht-i-Anghuzeh-i-khâlis) grows wild on the hills of Khorasán in very stony ground. The hill-men collect the gum-resin, taking an advance from the merchants. The time for collecting it is in the spring. The plant is not nearly so large as that which produces the Asafœtida of European commerce (Darakht-i-Anghuzeh-i-Lári), the diameter at the crown of the root being seldom more than two inches. The collectors protect each plant by building a small cairn of stones round it; they also remove the soil from the upper portion of the root, making a kind of circular basin. When the stem begins to grow it is cut off, and the upper part of the root being wounded, a small quantity of very choice gum is collected, which seldom finds its way into the market. Afterwards a slice of the root, about ¼ inch thick, is removed every two or three days with the exudation adhering to it, until the root is exhausted. The collected mass, consisting of alternate layers of root and gum-resin, when packed in skins (in quantities of about 100 lbs.) forms the *Hing* of Indian commerce; it is imported into Bombay in large quantities (about 2,500 cwts. annually), and is valued at the Custom House for assessment at Rs. 55 per cwt., commercial Asafœtida (Hingra) being only valued at Rs. 20. Early in 1874, the late Mr. Hanbury was kind enough to forward to one of us the proof-sheets of the article upon Asafœtida in the *Pharmacographia*, with a request for further information upon the subject. Unfortunately this could not be obtained in time for publication in the first edition of that work, as it involved sending to Persia for specimens of the plant and drug. In August, 1874, through the kindness of Mr. Ardeshir Mehrban, the first box of specimens was obtained, collected in the neighbourhood of Yezd. It contained—*1st*, the fresh root, with gum-resin adhering to the broken portions, and from which, upon section, a further exudation took place, at first opaque and milky, but drying in the course of a day or two into a light brown translucent substance;

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2nd, the flower stem with flowers and very immature fruit; *3rd*, the leaves. The plant arrived in a broken state, and was forwarded to Mr. Hanbury. Upon its receipt, he wrote:—"This morning I have devoted to the Asafœtida plant, and to a comparison of it with the figures and descriptions published by Borszczow, Balfour, and Hooker; but to decide on its botanical name is at present a difficult, if not impossible, task. I suppose it to be either the Narthex of the Edinburgh garden, or the Scorodosma of Borszczow, admitting for the moment that these are two good species; but the specimen does not furnish all the characters requisite for a strict comparison. I cannot tell whether the plant has the great sheathing petioles that form so striking a feature of the Narthex, nor is it possible to say whether the flower stem bore umbels arranged in a tall regular obelisk as Narthex, or crowded towards the summit as in Scorodosma. The foliage might do for either plant, though in having shorter segments it better agrees with the latter. The inflorescence which I have soaked and dissected consists of fertile female, and abortive flowers, none staminiferous. They are remarkably glabrous, not pubescent, as in Borszczow's plant; but this is of small moment."

Early in 1875, another box of specimens, with ripe fruit and a large supply of leaves, was obtained. In acknowledging it, Mr. Hanbury wrote:—"The box containing the Asafœtida plant arrived on the 29th January in excellent order, and its contents have given me great pleasure. The large plant though it had been rudely broken up and stuffed into a narrow space, proved to be fairly perfect; and by soaking in cold water I was able to restore it to shape, and then to fix it together so as to make a really beautiful specimen, measuring three feet six inches in height. The leaves, also, by soaking them and taking some pains, form very decent herbarium specimens, and there are enough of them to supply several collections. But the chief point with me has been to determine the plant. From the foliage, the pink colour of the stem, and the size of the fruit, I judged it might be the *Ferula alliacea* of Boissier; but there being no specimen of this at

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Kew, I had to transmit a portion to *M.* Boissier, in Switzerland. His reply was definite. The plant from Yezd agrees in foliage exactly with *F. alliacea*, in stature, size of fruit, and other respects; but the fruit has a broader margin than in *M.* Boissier's specimens. However, *M.* Boissier thinks it may be set down as that species, a conclusion in which I entirely agree. *Ferula alliacea* was previously known to me only by description. You will observe that we have named it in the *Pharmacographia* as a possible source of Asafœtida. I have thought it right to make a wide distribution of the fine supply of seeds with which you have favoured me, and I have therefore sent packets to the Botanical Gardens of Kew, Edinburgh, Oxford, Paris, St. Petersburg, Bern, Strassburg, Florence, Pisa, Naples, Palermo, Athens, and to botanical friends on the Mediterranean Coast, in South Africa, and a few other places. As the seeds seemed fresh and good, I am in hopes that many plants may be raised."*

Chemical composition.—According to Hirschsohn, Asafœtidas may be divided into two groups—*viz.*, those which yield umbelliferon amongst other products upon dry distillation, and those which do not. The first group of umbelliferon yielding samples, to which the European commercial Asafœtidas belong, is distinguished by the alcoholic tincture being precipitated by acetate of lead and the fluorescence of the sulphuric acid solutions. The second group to which the Bombay kind belongs are not precipitated by acetate of lead, and their sulphuric acid solutions are not fluorescent. The turning of a red colour on exposure to light, and the malachite-green spots produced by nitric acid (first observed by Flückiger) also distinguish the common Asafœtidas from the Indian; it may also be particularly mentioned that stem-remains are found in some kinds of common Asafœtida, while the Bombay kind always contains slices of roots.

Petroleum-ether, besides extracting the essential oil, extracts a non-volatile substance which greases paper. The

* For a review of the botanical literature of the Asafœtida plants, see Holmes in *Pharm. Journ.* 3rd Ser. xix., 21-34; 41-44; 365-368.

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extractive matter can be used to distinguish the two kinds of Asafœtida, and also to estimate their worth; Asafœtida of an ordinary commercial quality in tears yields at least 7 per cent. extract to petroleum-ether, lump at least 5 per cent. The volatile constituents should not be less than 5 per cent. in tear or 3 per cent. in lump Asafœtida. Good Indian Asafœtida should yield at least 11 per cent. to petroleum-ether, and this residue should not lose more than 6 per cent. when heated to 120° C.

Flückiger has obtained from Hing a reddish essential oil having a specific gravity of 1·02 at 25 C., and deviating 38·8 to the right, when examined in a column of 100 millimetres in length.

Commerce.—Hing is known in the Bombay market as Abushaherí Hing; it arrives in skins which contain about 100 lbs.; latterly some boxes have been received. The quality varies greatly, inferior parcels contain an undue portion of the root; in Bombay it is often still further adulterated by mixing it with gum Arabic in different proportions, according to the priced article required. To do this the package is broken up and moistened, the gum is then added, and the whole trodden together by men with naked feet upon a mat. When sufficiently mixed, it is sewn up in skins to imitate the original packages. Recently adulteration with sliced potato has been observed. Hing of good quality is worth about Rs. 80 per cwt. in Bombay.

FERULA FŒTIDA, *Regel.*

Fig.—*Bentl. and Trim., t.* 127; *Trans. Linn. Soc. 2d. Ser. Botany, Vol. iii., Pt. i., pl.* 12, 13, 14.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Hing (*Hind.*), Hingra (*Guz.*), Káyam, Perungáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*)

History, Uses, &c.—Commercial Asafœtida is collected from this plant in Western Afghanistan and Persia; in May,

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the mature roots begin to send up a flowering stem, which is cut off and the juice collected in the manner described by Kæmpfer, who witnessed its collection in the province of Laristan in Persia. It was long supposed that commercial Asafœtida was the produce of *F. Narthex*, Boiss., a Tibetan plant which was discovered by Falconer in Astor, but there is no evidence of the drug ever having been collected from it. In May, 1884, Dr. Peters, of the Bombay Medical Service, when stationed at Quetta, observed the flowering stem of an Asafœtida plant which was being offered for sale in the bazar as a vegetable by the Kákar Pathans. Specimens which he kindly forwarded to one of us were identified by Mr. E. M. Holmes as *F. fœtida*, Regel. Dr. Peters also found the dried root of the same plant in the drug shops, and learned that it was the plant from which Asafœtida was collected in Western Afghanistan. These facts were confirmed by Aitchison in May 1885, both as regards the source of commercial Asafœtida, and the use of the flower stalk as a vegetable. In his report upon the Botany of the Afghan Delimitation Commission, he remarks:—"In all stages of its growth, every part of the plant exudes upon abrasion a milky juice, which is collected and constitutes the drug of commerce. The stem in a young state is eaten raw or cooked." Aitchison says that a red clay called Tawah (توه) is mixed with the gum-resin at Herat, a statement which is only applicable to the kind of Asafœtida known in commerce as *Kandahari Hing*, to be presently noticed. Concerning the Láristan plant we are still without exact information, but we think it will prove to be *F. fœtida.* The remarks made respecting the use of Asafœtida by the natives of India under *F. alliacea* are more or less applicable to the present article, which is often imposed upon the poorer classes as a substitute for the more expensive Hing. In modern European medicine, Asafœtida is used as a stimulant and antispasmodic in chronic bronchitis, hysteria and tympanitis; it is often administered in the form of enema, as it is apt to give rise to a sense of weight and heat in the stomach when given by the mouth. Dr. Paolo Negri has reported the

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successful treatment of two cases of abortion with Asafœtida administered to the extent of one gram daily. In the first case the woman had aborted twice and in the second four times; both patients were free from syphilitic taint, and no cause for the abortion could be detected.

Description.—The best Hingra occurs in tears or flat pieces, upon the under-surface of which particles of sand often adhere; the external surface is yellowish; but the fresh fracture is of a pearly white, which by exposure to the air becomes bright pink and finally dirty yellow. Inferior samples consist of agglutinated tears, with a certain proportion of moist brown clammy gum-resin filling up the interspaces between them. Sometimes the Asafœtida which comes from Persia is a homogeneous soft white mass like clotted cream; these parcels upon exposure to the air develop an unusually bright pink colour. The drug has a powerful but not purely alliaceous odour, and a bitter acrid taste.

Microscopic structure.—In the root, portions of which may sometimes be obtained from a mass of second sort Asafœtida, there may be seen a perfectly regular arrangement of the zones, contrasting strongly with the root of *F. alliacea.* It is like that root remarkable for very large laticiferous vessels, but these are distributed symmetrically, the largest occupying the outer radius of the section.

Chemical composition.—Asafœtida consists of resin, gum and essential oil, in varying proportions, but the resin generally amounting to more than one-half. The authors of the *Pharmacographia* say:—

"As to the oil we have repeatedly obtained from 6 to 9 per cent. by distilling it from common copper stills. It is light yellow, has a repulsive, very pungent odour of Asafœtida, tastes at first mild, then irritating, but does not stimulate like oil of mustard when applied to the skin. It is neutral, but after exposure to the air acquires an acid reaction and different odour; it evolves sulphuretted hydrogen. In the fresh state, the oil is free from oxygen; it begins to boil at 135° to 140°

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C., but with continued evolution of hydrogen sulphide, so that we did not succeed in preparing it of constant composition, the amount of sulphur varying from 20 to 25 per cent.

"We found it to have a sp. gr. of 0·951 at 25° C., and a strong dextrogyrate power. If a drop of it is allowed to float on water it assumes a fine violet hue on exposure to the vapours of bromine.

"The essential oil of Asafœtida submitted to fractional distillation yielded us, at 300°, a considerable proportion of a most beautifully blue-coloured oil. By very cautiously oxidizing the crude oil, we obtained a small amount of extremely deliquescent crystals of a sulphonic acid. Sodium or Potassium decomposes the oil with evolution of gas, forming Potassium sulphide; the residual oil is found to have the odour of cinnamon.

"The resin of Asafœtida is not wholly soluble in ether or in chloroform, but dissolves with decomposition in warm concentrated nitric acid. It contains a little *Ferulaic acid*, crystallizing in iridescent needles, soluble in boiling water; it is homologous with eugetic acid.

"Fused with potash, ferulaic acid yields oxalic and carbonic acids, several acids of the fatty series and protacatechuic acid. The purified resin treated in like manner yields resorcin; and by dry distillation, oils of green, blue, violet, or red tint, besides about ¼ per cent. of Umbelliferon, $C^9H^6O^3$."—(*Pharmacographia*, 2nd *Ed.*, *p.* 318). E. Schmidt (*Archiv. der Pharm.* (3) xxiv., 534, 535,) has extracted small quantities of Vanillin from Asafœtida by the following process:—The powdered Asafœtida was repeatedly exhausted with ether, the filtrate shaken up with concentrated hydrogen sodium sulphite solution, and the liquid thus obtained supersaturated with dilute sulphuric acid. After expelling sulphurous anhydride, the extraction with ether and subsequent treatment was repeated, and a third extraction made. After removing the ether by distillation, the resulting vanillin was dissolved in water, and the filtered solution allowed to evaporate over sulphuric acid; well formed crystals were thus obtained.

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Kandahari Hing.—This substance appears to have been quite unknown in Europe, until brought to the notice of Professor Flückiger and the late Mr. Hanbury by one of us. We have not as yet been able to obtain authentic specimens of the plant, but for the following reasons we consider it likely that it will prove to be the same as that which produces the officinal drug:—

1. Bellew mentions a very high-priced Asafœtida obtained by wounding the leaf-bud of the plant which produces ordinary Asafœtida; our article is generally mixed with numerous leaf-buds, which have evidently been cut off by a sharp knife; its price is also much higher than that of any other kind.

2. When examining a number of bales of common Asafœtida from Kandahar, we found some of them to contain particles of the more expensive drug, and a large quantity of what appeared to be gum-resin in a transition stage between the transparency of Kandahar Hing and the opacity of the commercial article.

3. A portion of root found in a bale of Kandahar Hing agreed exactly with a piece obtained from a bale of common asafœtida.

4. Aitchison describes the juice of *F. fœtida* as a thick gummy reddish substance, and notices its adulteration with red clay; this adulteration is only found in bales of Kandaharí Hing.

Kandaharí Hing comes to Bombay in small quantities; it is sewn up in goat skins, forming small oblong bales, with the hair outside. When it first arrives it is in moist flaky pieces and tears, from which a quantity of reddish-yellow oil separates on pressure; the gum-resin also is of a dull reddish-yellow colour, soft, and somewhat elastic, with an odour recalling that of garlic and oil of caraways. By keeping, it gradually hardens and becomes brittle and of a rich red-brown colour; the odour also becomes more purely alliaceous, and approaches that of the commercial kind. This kind of Hing is almost entirely consumed in Bombay by the manufacturers of adulterated

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asafœtida, its strong odour and flavour make it especially valuable for this purpose, The average value is Rs. 25 per Surat maund of 37½ lbs., but as the bales often contain masses of a red clay, the actual price of the clean gum-resin is much higher.

Commerce.—Hingra arrives in Bombay from Persia and Afghanistan. The Persian is produced in the province of Láristán, and is known to Persian merchants as Anghuzeh-i-Lári; it often arrives in a moist condition, but soon hardens. The latter comes from the country about Herat *viâ* Kandahar, and is generally hard and dry. Very fine samples in tears are not uncommon. The stony asafœtida described by Pereira is also met with in India; it is simply a mixture of very fluid common asafœtida with the white sandy soil of the country in which the plant grows; it fetches a very low price, and as far as we can make out, the mixture is made more for convenience of carriage than for the purpose of deception. Besides, when the juice is unusually fluid, it runs out upon the surrounding ground and becomes mixed with the sand. The imports of Hingra into Bombay are about 2,500 cwts. annually from Persia and Afghanistan. Value Rs. 10 to 20 per maund of 37½ lbs. The total imports of Asafœtida of all kinds into British India during the last five years have been 37,306 cwts., the aggregate exports have only been 2,014 cwts.

FERULA GALBANIFLUA, *Boiss et Buhse.*

Fig.—*Trans. Linn. Soc. 2d Ser. Bot. Vol. iii., Pt. i.,* 15, 16, 17.

Hab.—Persia. The gum-resin.

Vernacular.—Jawáshir (*Arab., Ind. bazars*), Gaoshir, Barzhad, Biriz (*Pers.*).

History, Uses, &c.—Besides the plant which is placed at the head of this article, Boissier makes another species, *F. rubricaulis*, to grow in Persia. Borszczow, however, regards it as only a variety of *F. galbaniflua.* He states, though not from personal observation, that its gum-resin, which constitutes

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Persian galbanum is collected for commercial purposes round Hamadan. Aitchison says that *F. galbaniflua* is called in the Badghis territory near Herat *Badra-kema*, and that the fresh plant has an odour like celery. The gum-resin which usually exudes from cracks at the base of the stem is called by the peasantry *Shilm-i-barzad* or *Barzad-i-gaoshir* or *jawáshir;* it is said to be given to parturient women, and to be hung round the house to keep evil spirits away at the time of parturition.

Persian brokers in Bombay state that the galbanum plant is very abundant between Shiráz and Kirman, and there would seem to be no reason to doubt that the Indian market is partly supplied from that district.

The old Hindu writers make no mention of galbanum; Ainslie found that the Tamil physicians were unacquainted with it. In many Mahometan works the notices of galbanum appear to have been copied from Greek writers, the synonyms given being generally Barzad and Kinneh, but Haji Zein in the Ikhtiarát, A.D. 1368, describes two kinds of the drug,—one hard and whitish, and the other soft and yellow, like honey; the latter, he says, is called Jákushi at Shiraz.

The author of the Makhzan-el-Adwiya, speaking of Barzad, says it is called Kinneh in Arabic, Khalbani in Greek,* and Bireja or Ganda-biroza in Hindi, and is the produce of an umbelliferous plant like that which produces Sagapenum; but, he adds, that the drug which he has met with in India under these names is the produce of a tree called Deodar growing in the North of India. His experience accords with that of the present day, the only Ganda-biroza obtainable being the turpentine of *Pinus longifolia.* In India Persian galbanum is known as Jawáshir; on referring to the Makhzan we find this word explained as an Arabic corruption of the Persian Gaoshir. The author says, that it is a fetid gum-resin, and describes its collection from an umbelliferous plant, its

* Conf. Dios. περι χαλβάνης iii., 88; Theoph. H. P. ix, 1; Pliny 12 56; 24, 13.

appearance, &c., and with regard to its properties informs us that it is attenuant, detergent, antispasmodic and expectorant, and is prescribed in paralytic affections, hysteria, chronic bronchitis and asthma,* also on account of its supposed stimulant action upon the uterus. Externally it is used as a plaster. In short, he enumerates the uses to which galbanum is generally applied. It appears then that the Mahometan physicians of the East have been in doubt as to the identity of the Persian Jawáshir and the galbanum of Greek writers. In India galbanum is little used, the bulk of what is imported into Bombay being sent to Egypt and Turkey as Jawáshir. It is hardly necessary to add that those writers who have identified Jawáshir with Opoponax can never have seen the latter drug. We have never met with Opoponax in India.

Description.—Persian galbanum as met with in the Indian market is a yellow or greenish yellow semi-fluid substance having an odour between that of Levant galbanum and sagapenum; it is generally mixed with portions of the stem, flowers, and fruit of the plant: in some samples the outline of separate tears may be traced. When kept for some time it gradually becomes quite hard and dry. Occasionally samples, which seem to have been collected in a different manner, find their way to India: these contain slices of root and gum-resin in hard, dry tears, like that of Levant galbanum.

Chemical composition.—According to Hirschsohn, good Persian galbanum should yield to petroleum spirit not less than 65 per cent. consisting of volatile oil and resin, the average yield of Levant galbanum being between 60 and 63 per cent. The amount of ash in Persian galbanum should not exceed 4 per cent., being less than the ash of ordinary lump Levant galbanum by 2 per cent. The best Levant in tears gives the same ash as clean Persian. As a qualitative reaction to distinguish the varieties of galbanum, hydrochloric acid can be used, as it colours the Persian resin yellow-red

* The Jawáshir pill often prescribed in asthma consists of equal parts of Jawáshir and colocynth pulp rubbed up with honey.

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passing into red, and the Levant different shades of violet. The petroleum spirit-extracts from the Persian sorts give with nitric acid a rose-red colour; those from the Levant sorts different shades of violet. Bromine vapour colours the Persian weakly or intensely violet, but the Levant yellow.

The ether-resin from both kinds of galbanum upon boiling with water, gives indications of umbelliferon.

As to the origin of galbanum, the author believes from its varied behaviour with reagents, the different action of the volatile oils upon polarized light, and the different proportions of volatile oil to the gum-resin, that it is derived from different plants. He also points out that the Levant galbanum occurring in commerce contains no fruit and seldom stalks, but always slices of root, whilst the Persian galbanum always contains fruit and stalks.

According to Messrs. Schimmel & Co., galbanum oil is of a pale yellow colour, and possesses a pronounced odour of the gum. Its specific gravity at 15° C. is 0·914; it boils, apparently without decomposing, between 165° and 300°.

A sample of galbanum, collected from *F. galbaniflua* in Persia by Aitchison, and examined by E. G. Baker in 1886, gave the following results:—

Volatile oil	3·108
Resin soluble in ether	61·200
" " alcohol	7·576
Gum soluble in water	17·028
Insoluble matter	10·560
	99·472

Sulphuric acid coloured the gum-resin a dark brown; cold hydrochloric acid hardly affected it, but when boiled the mixture turned a dirty red colour, which was not altered by alcohol. A small portion of gum-resin boiled in water and allowed to cool gave on the addition of ammonia a faint blue fluorescence indicating the presence of umbelliferon; it contained no sulphur. (*Pharm. Journ.*, 1886, *p.* 468.)

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Commerce.—Galbanum is imported from Persia into Bombay. It is collected in the Hari-rud Valley and Bádghis (*Aitchison*); it is also said to be collected between Shiráz and Kirmán. The imports are very irregular, most of it is re-exported to Egypt and Turkey. Average value, Rs. 8 per maund of 37½ lbs.

DOREMA AMMONIACUM, *Don.*

Fig.—*Trans. Linn. Soc. 2nd Ser. Bot. Vol.* iii. *Pt. i.*, 23, 24, 25; *Jaub. et Spach. Ill. Pl. Or.* I., *t.* 40.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Ushak (*Arab., Pers., Indian bazars*), Kandal (*Afghan*).

History, Uses, &c.—This plant and *D. glabrum*, Fisch et Mey., both natives of Persia, are known to produce a gum-resin, but, according to Aitchison, that of the former plant is alone collected. Of the latter plant he says: It yields a yellow gum-resin; but I did not hear of its being collected; it is called Kema-i-ásp (horse Kema). Dioscorides speaks of ammoniacum as the juice of a narthex growing about Cyrene in Libya,* and it appears to have derived its name from the temple of Ammon. Pliny † derives it from 'Ammos,' sand. Most Greek and Latin writers on medicine mention its use in fumigation, and speak of it as *Thus Libycum, Ammoniacum thymiana,* or *Ammoniacum suffimen.* This kind of ammoniacum has now been ascertained to be the gum-resin of *Ferula Tingitana, Linn.*, which grows in Morocco. It was probably the only kind known in Europe in olden times. (*Confer. Pharmacographia*, p. 288.) The time when Persian ammoniacum first came into use cannot be exactly fixed.

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* Diosc. περὶ αμμωνιακοῦ, iii., 89. It had a reputation as a resolvent, especially in enlargements of the liver and spleen. Scrib. Comp. 128, 131. Persian ammoniacum has a similar reputation in India.

† 24, 14.

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It is not mentioned by the Greeks or Romans. Ibn Sina states that Ushak is the gum of the Tarthúth, and is called Lazák-el-dahab (= χρυσόκολλα), because it is used in gilding. His ammoniacum is doubtless Persian, like that of Abu Mansur Mowàjik, a Persian physician of the eleventh century, and of Ansári of the middle of the fourteenth century. The latter writer states that the Shirazí name for Ushak is Badrán. In Bokhara the gum-resin bears the name Kandal. According to Bunge and Bienert, the same name, and Kama, are given to the plant in Persia. Aitchison, who observed the plant in the Hari-rud valley, found it to be known to the natives as Ushak and Kandal-kema. He remarks: "No sooner is the fruit well formed and beginning to ripen than the plant is attacked by some boring insect, which causes the milky juice to escape. This dries into hard blocks, frequently enclosing the fruit."

According to Borszczow, *D. Ammoniacum* is called by the Kirghises Bal-kurai or "Honey-cane." The author of the *Makhzan-el-Adwiya* says that Ushak is an Arabic corruption of the Persian Ushnah or Ooshah, and that the drug is also called Khalbani, and in Arabic Ushajj, Wushajj, Wushok and Lazák-el-dahab. He gives the Greek names as Athánikun, Ammoniakun and Parnaksh, the Egyptian as Kinna, Shak and Kalakh, and the Indian as Kandar. Some Persian writers give Tarthúth as the Arabic and Samgh-i-bal-i-shírín as the Persian name. According to the dictionaries, Bal is the Persian for Tarthúth. Baghdádi tells us that Tarthúth is not the same as ammoniacum. In Bombay the current Persian name is Ushak. Mahometan works on Materia Medica describe the drug as discutient and attenuant; for more particular opinions respecting it the reader may consult the *Makhzan-el-Adwiya*, article Ushak. Sanskrit writers do not mention it. Besides the gum-resin, the root of *D. Ammoniacum* is largely imported into Bombay, and is one of the substances used by the Parsees as incense under the name of *Boi*, a word cognate with *Bu*, or *Bo*, fragrance. It is popularly spoken of as a wood. There can be little doubt that the use of this substance as an incense must date from a very remote period, otherwise the modern Parsees

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would not be at the trouble of importing it into India. Mr. K. R. Cama informs us that the "wood of fragrant trees" is mentioned in the Avesta as a class, and that one wood in particular is named, "*Hadha Nâeptanam*," which would mean translated into Persian, "Hamisheh naft," always moist, *i.e.*, green. He says: "In modern days we identify this wood, most likely mistakenly, with Pomegranate wood." It would appear then, that there is no specific description of Boi in the Avesta, but that it is traditionally understood to be one of the fragrant woods mentioned therein. It is this root which was some years ago exported to Europe as Bombay Sumbul, after having been cut up and impregnated with musk. When old and worm-eaten it becomes of a loose and spongy texture, and might easily be mistaken for Sumbul by a superficial observer.

Description.—Bombay is the chief mart for ammoniacum, and it is here that the original packages which come from the Persian Gulf ports are opened and sorted for the various markets.

The bales, generally of matting or coarse canvas, frequently contain all parts of the plant broken up and encrusted with the adherent exudation. Seed in the mature state is separated in large quantities, and is readily eaten by cattle. It would appear then that the collection takes place after the plant has matured its fruit, and that hardly any attempt is made by the collectors to separate the plant from the gum-resin; the latter exudes from every part, even the fruit is coated with it, and perforated by insects in the same manner as the stem.

Ammoniacum is usually sorted into three qualities—large tears, middle-sized tears, and small; the last kind is often carelessly picked, and contains dirt and other refuse. If the drug is kept in Bombay during the monsoon, the tears get soft and unite into a lump.

The roots vary in size, the largest being three inches in diameter at the crown; they are generally more or less forked; the root bark is thin and papery like that of the Sumbul, but the root itself is compact, and has a resinous section. A small

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specimen, powdered and exhausted with boiling water, yielded about one ounce of dark-coloured ammoniacum.

Chemical composition.—The following account is extracted from the *Pharmacographia*.—"Ammoniacum is a mixture of volatile oil with resin and gum. We obtained only ⅓ per cent. of oil, which we find to be dextrogyrate; we failed in obtaining a terpine from it.

"The volatile oil, which is lighter than water, and has the precise odour of the drug, contains, according to our experiments, no sulphur; a similar observation was made by Przeciszewski. Vigier, who obtained the oil to the extent of 1·8 per cent. by distilling the gum-resin with water, asserts that it blackens silver, and that by oxidation with nitric acid, he detected in it sulphuric acid. He states that with hydrochloric acid, the oil acquires a fine violet tint, passing by all shades to black; we failed in obtaining this coloration. By diluting the oil with bisulphide of carbon, and then adding mineral acids, we observed only yellow coloration. The oil diluted with alcohol acquires a red hue with ferric chloride.

"The resin in ammoniacum usually amounts to about 70 per cent. It is separable, according to Przeciszewski, into two substances—the one a resin having acid properties, the other an indifferent resin. He asserts that the indifferent resin when heated yields sulphuretted hydrogen. Our own experiments failed to show the presence of sulphur in the crude drug; and the same negative result has been more recently obtained in some careful experiments by Moss. Water, when boiled with the resin, acquires a yellow hue and slightly acid reaction; the liquid assumes an intense red coloration on addition of ferric chloride.

"Ammoniacum yields no umbelliferon; when melted with caustic potash it affords a little resorcin. The mucilaginous matter of the drug consists of a gum readily soluble in water, and a smaller quantity of about ¼ of an insoluble part, no doubt identical with that occurring in Asafœtida and galbanum. The aqueous solution of the gum of ammoniacum is very slightly

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levogyre." (*Confer. Hirschsohn Phar. Zeitscrift für Russland, April* 15, 1875, p. 225.)

Commerce.—All the Ammoniacum which reaches Bombay comes from Persia.

Value, about Re. ½ per lb.

The root is also imported from Persia. Value, Rs. 4 to Rs. 5 per Bombay maund of 28 lbs.

DOREMA AUREUM, *Stocks.*

Fig.—*Hooker's Jour. of Botany, iv., p.* 149.

Hab.—Beluchistan.

The gum-resin of this plant, gathered by Dr. Stocks in Beluchistan, is described as being an opaque cream-coloured substance, closely resembling in taste, smell and general appearance the ammoniacum of commerce. We have made enquiries for it in the Sind bazars, but cannot find that it is anywhere an article of commerce.

SAGAPENUM.

Vernacular.—No Indian names. Sagbinaj (*Arab. Indian bazars*), Iskabinah (*Pers.*).

History, Uses, &c.—This drug is supposed to be the juice of *Ferula Szovitsiana,* DC., but there appears to be no record of its collection from that plant. Aitchison speaks of *F. Szovitsiana* as a rigid herb, scarcely two feet high; common in the stony country and gravelly plains of the Hari-rud valley, the root stock of which possesses a slight odour of asafœtida. The fruit frequently present in commercial sagapenum is similar in shape to that of *F. galbaniflua,* but larger and of a yellow colour.

Sagapenum was known to the Greeks, and through them the early Arabian writers probably became acquainted with its medicinal properties. Dioscorides speaks of it as the juice of a ferulaceous plant growing in Media, and says that it has an odour between that of silphium and galbanum, whence we may

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infer that the odour of silphium was alliaceous. Pliny says that it is used to adulterate laser and galbanum. We see no reason to suppose that the ancient Hindus knew the drug, although Kundel is in some books given as the Sanskrit and Hindí name for it. The author of the *Makhzan-el-Adwiya* gives a sufficiently accurate description of Sagbínaj, and tells us that it is obtained from the district of Mah, near Ispahán. Persian brokers in Bombay state that the drug brought to this market is collected in the country between Shiraz and Kirmán. It is necessary to remark that Persian Sagapenum is distinctly different from what is known as Levant Sagapenum. Mahometan physicians consider Sagapenum to be attenuant and resolvent; when combined with purgatives it is thought to exert its resolvent power upon every part of the system, removing noxious humours; they also value it as an anthelmintic and emmenagogue. For a full account of the diseases in which it is prescribed, we must refer the reader to the *Makhzan-el-Adwiya*, article Sagbînaj. A sagapenum pill is often prescribed in flatulent dyspepsia; it contains equal parts of Aloes, Sagapenum, Bdellium and Agaric. Two to three dirhems are to be taken with warm water.

Description.—Sagapenum generally arrives in Bombay in masses weighing from four to ten pounds, tied up in coarse cloth, but occasionally parcels consisting of fine, dry, separate tears are seen.

The masses are made up principally of tears, which being mixed with a proportion of soft gum-resin, adhere together, forming a brownish-yellow cake; when fresh some of the tears have a greenish tinge, and are more or less opaque, but by keeping they all become brownish-yellow and translucent. The dry tears are always of a brownish-yellow.

The odour is distinctly alliaceous, but in other respects is much like that of Persian Galbanum.

Chemical composition.—Persian Sagapenum and Persian Galbanum closely resemble each other, and the same may be said of Levant Sapagenum and Levant Galbanum. As charac-

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ters for distinguishing Sagapeum from Galbanum may be used—(1*st*), the presence of sulphur in Sagapenum; and (2*nd*), their behaviour towards petroleum spirit, Persian Sagapenum yielding to it 2 to 5 per cent. and Levant 6 to 12 per cent. of resin, whilst the resinous residue from Persian Galbanum amounts at the most to 0·2 to 0·3 per cent. and that from Levant Galbanum to 1 per cent. (*Confer. Hirschsohn Phar. Zeitschrift für Russland, April* 15, 1875, *p.* 225.)

Commerce.—The quantity annually imported into Bombay varies greatly; most of it goes to London. It is seldom to be obtained in the retail shops. Value, Re. ½ to Re. ¾ per lb.

ARALIACEÆ.

Many species of Aralia are cultivated in gardens in India on account of their foliage. Loureiro tells us that they are used medicinally in Cochin-China, and are aperient, diuretic and diaphoretic. The famous *Ginseng* of China is derived from this family, and our Indian gardeners have discovered antifebrile properties in *Aralia Guilfoylia,* which they have named *Tápmári,* "fever killer." We have found that a syrup prepared from the leaves is a useful expectorant in cough. The leaves of most of the Aralias have a strong odour of Ivy when crushed. *A. Guilfoylia* is the *Frutex aquosus femina* of Rumphius (VI., 51), who states that it reduces heat in fever. *Aralia Pseudo-ginseng,* Benth., *Wall. Pl. As. Rar. t.* 137, is a native of Nepal, Sikkim, Bhotan and the Khasia mountains. Mr. C. B. Clarke considers it to be doubtfully separable from the true Ginseng of Japan, *Panax Ginseng,* C. A. Meyer, which differs by having broader, more obovate, less bristly leaves, and not by the characters relied on by Meyer. The Indian examples show every form of root stock and tuber attributed specially to *P. Ginseng* and to *P. quinquefolius,* Linn.; the scale at the base of the stem is persistent even in some of Wallich's specimens. (*Fl. Br. India.*) Ginseng enjoys in its native country the reputation of a panacea, and especially of

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being aphrodisiac. The affections for the cure of which it is most esteemed, are such as are usually treated by aromatic stimulants, including dyspepsia, vomiting, and nervous affections. It is used as a masticatory and also in infusion, and is occasionally brought to India by the Chinese.

Description.—Ginseng root is fusiform, 4 to 6 inches long, with a rounded head, closely annulate, and with few wrinkles above, dividing below into two, or occasionally three, branches of even size. The branches are not, or are but slightly, annulate, and are longitudinally wrinkled. The root is externally of a brownish-yellow colour, internally white, breaks with a short and mealy fracture, and has a faint sweetish odour and a sweet slightly aromatic taste. The transverse section shows a thick bark, with numerous scattered brown-red resin-cells, and in older roots is radially striate from the bast-wedges; it is separated by a brown cambium-line from the central portion, which consists of linear wedge-shaped yellowish wood-bundles and broad medullary rays.

Chemical composition.—Besides starch, gum, albumen, and resin, S. S. Garrigues (1854) isolated a sweet principle, *panaquilon*, $C^{12}H^{25}O^{9}$, by adding to the syrupy infusion a concentrated solution of sodium sulphate and dissolving the precipitate in alcohol. It is yellow, amorphous, sweet, insoluble in ether, and precipitated by tannin. Concentrated sulphuric acid dissolves it with a purple-red colour, converting it at the same time into *panacon*, $C^{11}H^{19}O^{4}$, which is white, tasteless, and insoluble in water and ether, but soluble in alcohol.—(*Stillé and Maisch.*)

We have examined the leaves of *Aralia Guilfoylia*, which have an odour like fœnugreek, due to an odorous principle which was dissolved out by ether and stronger alcohol, but could not be obtained by distillation. The distillate was slightly acid, and contained a white fatty substance like a stearopten having quite a distinct odour from that of the drug. The aqueous solution of the ethereal extract was viscid, partly soluble in water, and the portion soluble gave

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the usual reactions for an alkaloid. The alcoholic extract was very sweet and contained a large quantity of a body readily reducing Fehling's solution; the extract also contained an organic acid and ammonia, an alkaloid, and a soluble chloride in the portion soluble in water. The resinous part of this extract insoluble in water formed a gelatinous magma with that menstruum, and instantly dissolved, without deepening of colour, with the aid of an alkali. The aqueous extract was sweet and had the peculiar odour of liquorice. It contained sugar and an organic acid similar to that found in the spirit extract; it gave a precipitate without colour with ferric chloride, mixed clear with gelatine, and precipitated with the mineral acids as a jelly-like substance. The ash amounted to 15·2 per cent., and consisted mainly of alkaline salts. The alkaloid contained in these leaves is not bitter.

CORNACEÆ

ALANGIUM LAMARCKII, *Thwaites.*

Fig.—*Wight Ic., t.* 194; *Ill., t.* 96; *Rheede Hort. Mal. iv., tt.* 17, 26.

Hab.—Throughout India. The roots, bark, seeds, and leaves.

Vernacular.—Dhera, Akola, Ankul (*Hind.*), Ankul (*Guz.*), Ankoli (*Mar.*), Ankalige (*Can.*), Bagh-ankura, Dhalákura (*Beng.*), Azhinji-maram, Alangi (*Tam.*), Uduga-chettu, Ankolam-chettu (*Tel.*).

History, Uses, &c.—This tree, in Sanskrit Ankota, Nikochaka, and Gupta-sneha, "the oil of which is hidden," is described in the Nighantas as bitter, mucilaginous, pungent, light and aperient; it expels worms, wind, phlegm and poison. The fruit is cold and sweet, and begets phlegm, it is strengthening and aperient, and cures wind, bile, inflammations, phthisis and skin diseases. Rheede says:—"Cæterum arbor hæc varias ob causas emblema Regiæ majestatis Malabarensibus

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habetur, quarum præcipua est, quod flores diademati Imperiali haud absimiles, rigidis inhereant spinis. Insuper succus ex arboris radice expressus, et exhibitus vermes necat, nec non biliosos ac pituitosos humores per alvum expurgat, et aquas hydropicorum ducit."

Mr. Moodín Sheriff has drawn attention to the emetic properties of the bark in the *Pharmacopœia of India.* He says:—"It has proved itself an efficient and safe emetic in doses of fifty grains; in smaller doses it is nauseant and febrifuge. The bark is very bitter, and its repute in skin diseases is not without foundation. If it is continued for a sufficient period its influence over them is greater than that of *Calotropis gigantea.*" Mr. Moodín Sheriff, in a further report upon this drug (1883), states:—"It is a good substitute for Ipecacuanha, and proves useful in all diseases in which the latter is indicated, except dysentery. As a diaphoretic and antipyretic it has been found useful in relieving pyrexia. Dose as a nauseant, diuretic and febrifuge, 6 to 10 grains of the root bark; as an alterative, 2 to 5 grains; it is given in leprosy and syphilis; the natives consider it to be alexiteric, especially in cases of bites from rabid animals."

Dr. S. Arjun (*Bomb. Drugs,* p. 70,) states that the leaves are used as a poultice to relieve rheumatic pains.

The reports of several medical officers are quoted by Dr. Watt in his Dictionary of the Economic Products of India, but none of them, except Mr. Moodín Sheriff, appear to speak from personal experience.

Description.—Root heavy, wood close-grained, yellow, having an oily appearance; it and the bark turn of a dirty-green colour on being touched with a solution of perchloride of iron. The bark is of a cinnamon-brown colour, the external surface separating in thin corky flakes, which are studded with small circular warts. The inner layers are compact and of the same colour. Taste bitter, odour rather nauseous. The fruit is astringent and acid, ⅝ by ⅜ of an inch,

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black, closely pubescent or finally glabrous; endocarp bony. The leaves are 3—6 by 1—2 inches, oblong or elliptic, acute or subobtuse, base unequal, above nearly glabrous with pubescent nerves, beneath hairy and often with tufts of hair or hollow glands in the axils of the primary nerves.

Chemical composition.—The most interesting principle present in the roots, is a very bitter non-crystallizable alkaloid which we have provisionally called *Alangine*. It is soluble in alcohol, ether, chloroform, and acetic ether, and practically insoluble in water. With the mineral acids, and with acetic, tartaric, and oxalic acids we failed in obtaining crystallizable salts. From an alcoholic solution, on spontaneous evaporation, it occurs as a yellowish, varnish-like deposit wholly destitute of any crystalline structure. From an acid solution it is precipitated in white flocks by the addition of alkalies, and with the ordinary alkaloidal re-agents it affords marked precipitates. With concentrated sulphuric acid, alone or with the addition of potassium bichromate, no special colour reactions were observed. Fröhde's re-agent gave an indigo-blue coloration in the cold, and on gently heating and then cooling a very light brilliant blue resulted. With nitric acid a reddish brown solution was yielded, and on gently warming it nitrous fumes were evolved and the liquid became lighter in colour. A platinum salt was prepared which contained 20·703 per cent. of platinum on the salt dried at 100° C.

CAPRIFOLIACEÆ.

VIBURNUM FŒTIDUM, *Wall.*

Fig.—*Wall. Pl. As. Rar., Vol. i., t.* 61.

Hab.—Burma. Cultivated in India. The leaves.

Vernacular.—Narvel (*Mar.*), Naruval (*Can.*).

History, Uses, &c.—Though a native of Burma this shrub is found in cultivation throughout Western India.

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It appears to be confounded with, and to be used for the same purposes as *Premna coriacea*, Clarke, and other strong-smelling Premnas which bear the Sanskrit names of Sriparna and Jaya. How and when *V. fœtidum* was introduced into India is unknown; it seldom flowers and fruits here. It is customary for Hindu women who have been confined to hang a branch over the door of the room in which they lie, as a protection against evil spirits and post-partum hæmorrhage. Another superstition is, that if seven pieces of the stem of this plant are knotted into a thread made from cotton picked by a virgin, the necklace thus formed will cure scrofulous glands. A cake made from the flour of eighteen different kinds of grain with Narvel juice, is scraped while hot on one side, well moistened with the juice and applied to the head in headache. A wineglassful of the juice of the leaves is administered internally in menorrhagia daily, also in post-partum hæmorrhage. It is remarkable that *V. prunifolium*, an American plant, is also said to be useful in all uterine diseases characterised by loss of blood and in threatened abortion. (Cf. *Les Nouveaux Remèdes. Sept.* 8, 1888; *Etude sur l'emploi thérapeutique du Viburnum prunifolium, par le Dr. Debierre.*)

Two of the Viburnums are common garden shrubs in Europe, *V. Opulus* and *V. tinus*, the former is probably the θραυπαλος of Theophrastus; the fruit is edible. The cultivated variety of this plant is the Gueldres Rose, in which the flowers form a white ball. The latter is the well known Laurestine. *V. Opulus* is said to have the same medicinal properties as *V. prunifolium*. (*Purdy, On the use of V. Opulus in dysmenorrhœa and uterine pain. New York Med. Journ., Nov.* 1882.)

Description.—A shrub, leaves variable, usually ovate-lanceolate, serrated, length 1½ to 2 inches, flowers small, greenish white, berries small, ovoid, and of a vivid red colour. All parts of the plant have a powerful unpleasant odour like that of *Premna integrifolia.*

Chemical composition.—The *viburnic acid* of Krämer (1844) obtained from the bark of *V. Opulus* was proved by Monro

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(1845) to be identical with valerianic acid. The *viburnin* of Krämer is a light yellowish substance or whitish powder of a neutral reaction, and of a purely bitter taste; it is slightly soluble in water and more freely so in alcohol. Enz (1863) found in the fruit of *V. Lantana*, a hygroscopic neutral bitter principle readily soluble in water, also valerianic, acetic, tartaric and tannic acids.

The odorous principle of the leaves of *V. fœtidum* is removed by distillation in the form of fetid volatile oil, separating from the distillate in white greasy flakes neutral in reaction. The decoction remaining in the retort had a nauseous animal-like odour, and when filtered, showed the presence of much mucilage by giving gelatinous precipitates with ferric chloride, lead acetate and alcohol. Ether removed the fetid principle together with chlorophyll, some resinous matter, and a trace of alkaloid from the dried and powdered leaves. The alcoholic extract was sweet, with a peculiar sharpness on the palate, and was acid in reaction. The aqueous solution of this extract gave abundant precipitates with potassio-mercuric iodide, iodine solution, tannin and ferrocyanide of potassium, indicating the presence of an alkaloid, which was subsequently confirmed by separating it from this solution by the cautious addition of ammonia or caustic soda. Ammonia added to its solution caused a precipitate of cross-shaped crystals; soda threw down the alkaloid as a whitish powder, which agglutinated into a brown mass soluble in excess of the alkali The alkaloid had a peculiar sharp taste, was soluble in ethylic and amylic alcohol and chloroform, and slightly in water and ether. It formed a crystalline sulphate, hydrochlorate and nitrate. It gave no peculiar colour reactions with the strong mineral acids, but dissolved in nitric acid, and the solution when evaporated left a mass of crystals which had a fragrant odour when mixed with water. The alkaloid fused into a reddish mass when heated, and gave off alkaline fumes. The leaves left 12·25 per cent. of white ash when completely ignited.

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RUBIACEÆ.

ANTHOCEPHALUS CADAMBA, *Miq.*

Fig.—*Bedd. Fl. Sylv.* 127, *t.* 35; *Korth. Verh. Nat. Gesch. Bot.* 154, *t.* 48. Wild Cinchona (*Eng.*).

Hab.—Himalaya to Ceylon, wild or cultivated. The fruit and bark.

Vernacular.—Kadamb (*Hind.*, *Beng.*), Kalamb, Nhyu (*Mar.*), Vella-kadamba (*Tam.*), Kadambe (*Tel.*), Kadavála-mara (*Can.*).

History, Uses, &c.—This tree is sacred to Káli or Parvati, the consort of Siva; it is the *Arbor Generationis* of the Maratha Kunbis, and a branch of it is brought into the house at the time of their marriage ceremonies. The tree is planted near villages and temples, and is held to be sacred. In Sanskrit it is called Kadamba or Kalamba, and has also many synonyms, such as *Sisu-pála*, 'protecting children'; *Hali-priya*, 'dear to agriculturists,' &c. The Kadamba blossoms at the end of the hot season, and its night-scented flowers form a large, globular, lemon-coloured head, from which the white clubbed stigmas project. They are compared by the Indian poets to the cheek of a maiden mantling with pleasure at the approach of her lover, and are supposed to have the power of irresistably attracting lovers to one another. This idea is expressed in the following couplet of the Saptasatika of Hála:—"Sweet-heart, how I am bewitched by the Kadamba blossoms, all the other flowers together have not such a power. Verily Kama wields now-a-days a bow armed with the honey balls of the Kadamba." The flowers are fabled to impregnate with honey the water which collects in holes in the trunk of the tree. Beal, in his *Catena of Buddhist scriptures from the Chinese*, informs us that according to the Dirghagama Sutra, to the east of mount *Sume* rises a great king of trees called Kadamba; in girth seven yoganas, height a hundred yoganas, and in spread fifty yoganas. M. Sénart (*Essai sur la légende*

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du Buddha) says:—" L'arbre de Bouddha sort spontanément d'un noyau de Kadamba déposé dans le sol; en un moment, la terre se fend, une pousse paraît, et le géant se dresse ombrageant une circonférance de trois cents coudées. Les fruits qu'il porte troublent l'esprit des adversaires du Buddha contre lesquels les Dévas déchaînent toutes les fureurs de la tempéte." (*De Gubernatis.*) The fruit, which is about the size of a small orange, is eaten by the natives and is considered to be cooling and a destroyer of phlegm and impurities of the blood. The bark is considered to be tonic and febrifuge, and its fresh juice is applied to the heads of infants when the fontanelle sinks; at the same time a small quantity mixed with cumin and sugar is given internally. In inflammation of the eyes the bark-juice with equal quantities of lime-juice, opium and alum is applied round the orbit.

Description.—The bark taken from the larger branches occurs in thick flat pieces, the external surface is grey and studded irregularly with small, prominent corky lenticels; it shows numerous and extensive light brown scars caused by the separation of portions of bark due to the development of corky layers in its substance. The inner surface and substance of the bark is red and fibrous. Taste bitter and astringent.

Chemical composition.—The bark gave 9·8 per cent. of ash and 18 per cent. of alcoholic extract. The former contained calcium carbonate from the reduction of the oxalate present in the bark, and the latter contained an astringent principle. The extract soluble in water was red in colour, and gave a green precipitate with ferric chloride, a bulky flesh-coloured precipitate with gelatine, and a brick-red deposit with iodine solution. Treated with caustic alkali, a yellowish brown liquor was obtained, which gradually assumed a deep red and gave off the odour of cinchona bark solutions when treated under the same conditions. Boiled with dilute sulphuric acid for one hour a red deposit occurred in the decoction. The extract insoluble in water was for the most part soluble in diluted alkali with a rich red colour and a slight blue fluorescence. The solution

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precipitated with an acid, and the red magma separated and treated with lime water, afforded to the solvent no principle insoluble when acidified. The astringency of the bark is due to an acid similer to cinchotannic acid, and the drug contains a ready formed oxidation product of the nature of cinchona red. No alkaloidal principle is present.

ADINA CORDIFOLIA, *Hook. f.*

Fig.—*Brand. For. Fl., t.* 33; *Roxb. Cor. Pl. I., t.* 53.

Hab.—Throughout the hilly parts of India. The bark.

Vernacular—Haldu, Hardu, Karam (*Hind.*), Bangka, Kelikadam (*Beng.*), Manja-kadambe (*Tam.*), Paspu-kadambe, Dudagu (*Tel.*), Hedde, Yettega (*Can.*), Hedu (*Mar.*).

History, Uses, &c.—This tree is regarded by the Hindus as a species of Kadamba, and is the Dhárá-kadamba or Kalambaka of Sanskrit writers. It is well known in all parts of India for its bitter medicinal bark, and valuable yellow wood, which is used for many industrial purposes. The bark is a popular febrifuge amongst the agricultural classes, and ground into a paste with water it is much used as a local application to the sores and galls to which draught cattle are subject. It is considered to be antiseptic and to prevent the generation of worms in sores.

Description.—The bark occurs in thick curved pieces, externally light grey or dirty white, darkly shaded from the growth of a small Hepatica on its surface. Its inner surface and substance is reddish-brown and fibrous. Taste bitter and astringent.

Chemical composition.—The bark contains the same constituents as that of *Anthocephalus Cadamba.* The red-coloured tincture gave 32 per cent. of dried extract, calculated on the powdered bark. This extract contained an astringent acid like cinchotannic acid, a red oxidized product, a fluorescent bitter principle, but no alkaloid. Starch and calcium oxalate were present in the inner layers of the bark, and calcium

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carbonate constituted the greater portion of the 10·4 per cent. of ash obtained on combustion.

UNCARIA GAMBIER, *Roxb.*

Fig.—*Hunter in Trans. Linn. Soc. ix.*, 218, *t.* 22; *Korth. Verh. Nat. Gesch. Bot., t.* 34; *Bentl. and Trim.*, 139. The extract, Gambier, Pale catechu (*Eng.*), Gambir cubique (*Fr.*).

Hab.—Malacca, Penang, Singapore. The extract of the leaves, and young shoots.

Vernacular.—Chini-Katha or Kath, &c. (*Ind.*) In the Indian languages it bears the same name as Acacia Catechu, with the addition of the adjective Chinese.

History, Uses, &c.—We meet with no account of this substance in Hindu or Mahometan works on Materia Medica. Anslie mentions the drug, but he appears to have been very imperfectly acquainted with it, as in his first volume he describes the different kinds of catechu found in Southern India without noticing Gambier. (*Materia Indica, II., p.* 105.) Flückiger and Hanbury in their *Pharmacographia* remark that:—"If we may credit Rumphius, it would seem that the important manufacture of Gambier had no existence at the commencement of the last century. As to 'Gutta Gambier,' his statements are scarcely in accord with those of more recent writers. We may, however, remark that that name is very like the Tamil Katta Kambu, signifying catechu, which drug is sometimes made into little round cakes, and was certainly a large export from India to Malacca and China as early as the 16th century. That Gambier was unknown to Europeans long after the time of Rumphius, is evident from other facts. Stevens, a merchant of Bombay, in his *Compleat Guide to the Eastern India Trade*, published in 1766, quotes the prices of goods at Malacca, but makes no allusion to Gambier. Nor is there any reference to it in Savary's *Dictionnaire de Commerce* (Edn. of 1750), in which Malacca is mentioned as the great *entrepôt* of the trade of India with that of China and

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Japan. The first account of Gambier known to us, was communicated to the Batavian Society of Arts and Sciences in 1780, by a Dutch trader named Couperus. This person narrates how the plant was introduced into Malacca from Pontjan in 1758, and how Gambier is made from its leaves; and names several sorts of the drug and their prices. In 1807 a description of 'the drug called Gutta Gambier,' and of the tree from which it is made, was presented to the Linnean Society of London by William Hunter." A good description of the manufacture of Gambier will be found in the *Pharmacographia*. The process consists in boiling the leaves and young shoots and evaporating the liquor until it crystallizes.

Description.—Gambier is an earthy-looking substance of light brown hue, consisting of cubes about an inch each side, more or less agglutinated, or it is in the form of entirely compact masses. The cubes are externally dark reddish brown and compact, internally of a pale cinnamon hue, dry, porous, friable, devoid of odour, but with a bitterish astringent taste, becoming subsequently sweetish.

Under the microscope the cubes of Gambier are seen to consist of very small acicular crystals. (*Pharmacographia.*) Gambier is also imported into India in the form of small lozenges.

Chemical composition.—In chemical composition Gambier agrees with Kutch. (*See Acacia Catechu.*) Gambier from Singapore has lately been exported in a damp condition causing great inconvenience in the trade. Mr. W. N. Evans has analysed some authentic field and trade samples with the following results:—

	Gambier from field.	Trade Gambier.
Tannin	11·48	14·68
Organic matter	30·11	42·26
Water	53·39	31·89
Ash	4·46	6·34
Loss	0·56	4·88
	100·00	100·00

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A substance named *Than*, used to adulterate kutch in Burma, was investigated by Dr. Romanis in 1888. Than is a red-coloured gum or mixture of gums, insoluble in spirit, and having no action on polarized light. Under some circumstances it ferments and evolves gases. It contains no leather forming property, but is thrown down by gelatine and alum; if, however, this precipitate is boiled in water, the than is dissolved. (*Chem. Examiner's Report*, 1888.)

Commerce.—Gambier is imported into India from Singapore in large baskets. The exports of Kutch and Gambier from India are more than 300,000 cwts. annually.

Value, Rs. 4 to Rs. 6 per Surat maund of 37½ lbs.

CINCHONA SUCCIRUBRA, *Pavon.*

Fig.—*Howard's Illustrations, Neuva Quinologia. p.* 7. Red bark.

Hab.—Slopes of Chimborazo, S. America. Cultivated in Southern India, Sikkim and Ceylon.

CINCHONA OFFICINALIS, *Hooker.*

Fig.—*Bot. Mag.* 5364. The Loxa, Crown, Condaminea or pale bark of commerce.

Hab.—Ecuador and Peru. Cultivated on the Nilgiri Hills.

C. CALISAYA (*Wedd.*) and var. LEDGERIANA.

Fig.—*Howard's Quinology, pp.* 4, 5, 6. The Calisaya, Ledger, or yellow bark of commerce.

Hab.—Bolivia and Southern Peru. Cultivated in Sikkim and Southern India.

History, Uses, &c.—Cinchona bark was introduced into Europe in the 17th century, when it was brought over by Jesuit missionaries from America. The Countess of Chinchon, the wife of a Viceroy of the Spanish colony of Peru,

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had been cured of an attack of fever by its use, hence the early names of the medicine were *Peruvian or Jesuit's bark* and *Countess's powder*. The trees yielding this bark were not discovered until a century later, when La Condamine and Jussieu, members of a French exploring party, obtained some plants. Linnæus established the botanical genus Cinchona in 1742. Peruvian bark was acknowledged as a most valuable medicine soon after its introduction into Europe, and the consumption rapidly increased, but no care was spent over the preservation of the natural forests in South America. It would appear that the Jesuits in Peru about 1650 began to distribute the bark to those of their fraternity stationed in other parts of the world, as was their usual practice upon the discovery of any new article of economic value. In this manner it probably reached India not long after its discovery in America.

After its admission in 1677 to the London *Pharmacopœia*, it was necessarily sent out to the physicians of the English East India Company. Its use must have spread rapidly, as in 1770 we find a description of it under the English name of bark (بارک) in the *Makhzan-el-Adwiya* of Mir Muhammad Husain, showing that it was already well known to the native physicians. He describes it as a bark resembling Cassia bark but of a darker colour, and remarks that its medicinal properties are said to have been discovered in Peru by a sect of Christians called Jesuits, who first brought it to Europe, and for this reason it bears the name of Jesuit's bark. It is also called Kina Kina. He correctly describes its use as an anti-periodic, and pronounces it to be hot and dry in the second degree. Quinine appears to have been first used in India in 1826; the records of the Government Medical Store Department show that the Government of Bombay purchased for trial in that year a small quantity of the new medicine at the rate of £28-10-8 per lb. from Mr. Sprague, a chemist and druggist, who had recently opened a shop in Bombay.

The demands for Cinchona and Quinine from India soon became so large that Dr. Royle, botanist to the Indian

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Government, fearing that the supply might cease, or be obtainable at a price beyond the reach of the community, recommended to Government in 1839, and again in 1852, that the cultivation of Cinchona should be tried in the country. No steps were taken in the matter until Mr. C. R. Markham in 1860 was selected to organize an expedition to the forests of the Andes for the purpose of collecting seeds and plants. Mr. Markham, accompanied by Mr. Weir, a practical gardener, undertook to collect seeds of the Calisaya or yellow bark tree in the forests of Bolivia and Southern Peru. Mr. Pritchett was to explore the Grey bark region of Huanuco and Humalies in Central Peru, and Messrs. Spruce and R. Cross were to collect the seeds of the Red bark trees in the mountains of Ecuador. Mr. Markham succeeded in collecting several hundred plants of Calisaya, but these were lost owing to the treatment they received *en route* to India. The other collectors were successful in their undertakings, not however without some hardships and disappointments, and the first seed of the Grey barks arrived in India in January 1861, and those of the Red barks a few months later. Mr. Cross was subsequently commissioned to procure seeds of the *C. officinalis* in the forests near Loxa, and this commission he executed with so much success that the seeds were brought to India in 1862. The seeds and young plants on their arrival were committed to the care of Mr. W. G. McIvor, Superintendent of the Botanic Gardens, Ootacamund, and it was to his patience and skill that the cultivation of Cinchona in India became an accomplished fact. Cinchona cultivation was introduced about the same time in the Bengal Presidency under the direction of Dr. T. Anderson. The first seeds sent to the Sikkim Plantations were from Kew; these were soon followed by plants of Pahudiana, Calisaya and Lancifolia from Java, and some Succirubras from Ootacamund. The Cinchona was introduced in Ceylon in 1861 by Dr. Thwaites, and was subsequently taken up with much vigour by the planters of that island. Plantations were opened up afterwards in Wynaad, Mysore, Coorg, Travancore and Tinnevelly entirely as private specula-

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tions. For further information the reader is referred to "*Peruvian Bark*," by C. R. Markham; "*Cinchona Barks Pharmacognostically considered*," by F. A. Flückiger; Blue Books. *Copy of Correspondence relating to the Introduction of the Cinchona Plant into India, &c., with Maps.* 1852 to 1875, 5 volumes; *The Annual Reports on the Government Cinchona Plantations, Bengal and Madras*, up to 1889.

Small doses of cinchona preparations and quinine augment the force of the heart's constriction, increase the appetite, and act as a general tonic, but if too frequently repeated, the contractile power of the heart is diminished, although the rate of its movements progressively increases; the latter effect is also produced by large single doses. Poisonous doses annihilate the heart's contractility, producing rapid death; yet if the operation is not promptly fatal, the respiratory movements cease before those of the heart. Theoretically, in moderate doses, quinine stimulates the trophic centres, and quickens tissue change, but in large doses it has the opposite effect. The reduction of the pulse rate and force by quinine is attended by a reduction in temperature. Observations of the effect of quinine upon the blood corpuscles have led to no very satisfactory conclusions. When 5 or 6 grains of sulphate of quinine are taken by an adult man at a single dose, or two or three times that quantity in the course of 12 hours, there is apt to be some heaviness and confusion of thought, headache, buzzing in the ears, vertigo, and unsteadiness of gait. Larger doses occasion, in addition, a sense of fulness, tension, and pulsation in the head; the face becomes suffused and animated; the eyes are bright; epistaxis sometimes occurs; the patient is restless and agitated, and complains of muscular twitching in the limbs. After several hours these phenomena are followed by some degree of exhaustion and a disposition to sleep, with slight torpor and muscular debility. If as much as 30 grains are given daily for several days, in divided doses, there may be observed great depression, apathy, somnolence, unsteadiness of gait, impaired sight and hearing, and dilatation of the pupils; the general

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sensibility is obtuse and the limbs tremulous. If, finally, the dose has been excessive, complete loss of consciousness may occur, the sight and hearing fail, the skin loses its sensibility, and the limbs their power of motion.

The usual and most probable interpretation of these phenomena is that quinine in moderate doses primarily stimulates the nervous centres and increases the amount of blood circulating in them; that in excessive doses it diminishes the supply of blood to the same parts; and that this diminution results mainly from the depressed power of the heart. The most important fact in support of this view is that the giddiness, confusion of sight, and faintness caused by quinine subside as soon as the patient lies down.

On the *respiratory organs* the primary action of quinine is stimulant, slightly increasing the rate of breathing. Poisonous doses occasion dyspnœa and noisy respiration, which is also jerking, interrupted, retarded, and finally arrested, death taking place with symptoms of asphyxia. In some cases the sputa have been bloody. Doubtless the latter phenomena are due to a paralyzing influence exerted by quinine upon the respiratory nervous centres, coupled with an analogous action of the drug upon the cardiac nerves and ganglia. According to certain experiments upon rabbits (*Strassburg*), quinine does not diminish the exhalation of carbonic acid, even while it lowers the temperature.

On the *digestive organs* small doses of quinine, as of all pure bitters, stimulate the appetite and digestion, but in large and continued doses it irritates the stômach and confines the bowels at first, although it may afterward cause diarrhœa.

The fact that when quinine cures intermittent fever it also contracts the *spleen*, if that organ is enlarged, is a familiar one. It is also known that when quinine is largely administered to animals for various experimental purposes the spleen is found pale and hard and its capsule wrinkled. These effects occur even when all the nervous trunks supplying the organ are divided. Hence, it is concluded that quinine must act upon the

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internal nervous system of the spleen. (*Binz.*) The function of the organ, it is added, being to form the white corpuscles of the blood and to prepare various oxidized substances, and especially uric acid, for excretion, and quinine having the power of restraining both of these operations, necessarily the organ appropriated to them must contract in proportion to the restriction of its functions.

Quinine, being excreted with the *urine* to the extent of at least one-half, sometimes occasions irritation of the urinary passages, causing in different cases micturition, retention of urine, and even hæmaturia. (*Stillé and Maisch.*)

But the most important property of quinine is its destructive action upon the low animal organisms (hæmatozoa), whose presence in the blood has been shown by Laveran (*Archíves de Médecine Expèrimentale,* I., p. 789; ii., p. 1,) to be the exciting cause of malarial fevers. Previous to Laveran's great discovery, the power possessed by the cinchona alkaloids of preventing as well as curing these fevers had long been a well recognised fact, and it was known that a person under the influence of a dose of quinine (2 to 5 grains given once or twice a day) might be exposed to malarial contagion without danger. The antiseptic properties of quinine had also been sufficiently established, a dilute solution having been found to preserve fluids containing animal matter from putrefaction for a length of time, although it had not the same destructive action upon the lower forms of algæ as it had upon the lower forms of animal life. Laveran's observations, which have now been amply confirmed, show that the hæmatozoa of malaria are present in the blood in the greatest number immediately before the febrile paroxysm, which is an effort of nature for their destruction, and that the administration of the cinchona alkaloids, and more especially of quinine, has a marked effect in reducing the number of these parasites, and inasmuch as they remove the cause of the irritation, they also prevent the recurrence of the febrile paroxysms. (*Op. cit.* 1889—90; *Laveran, Traité des fièvrês palustres, Paris,* 1884.)

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Quinine has no power to originate uterine contractions in the pregnant female, but when once parturition has commenced, the flagging pains are greatly stimulated and increased by a dose of ten grains of the drug, and when abortion is threatened through malarial influence, no hesitation should be felt in using it. Quinine should always be given in some easily soluble form, as any salt of the alkaloid which escapes absorption in he stomach must be precipitated by the alkaline juices of the bowels, and be absorbed very slowly or not at all. Dr. G. Kerner has found it in the fæces partly in an amorphous form and partly as a crystalline bitter fluorescent substance, named *dihydroxyl quinine;* the alkaloid has also been found in the tears, sweat, milk, urine and saliva.

In malarial fevers quinine should be administered in such a way that the last dose should be ingested about 2 hours before the expected return of the paroxysm, and the first dose 4 or 5 hours previous to the last. When there is sufficient time, its influence is almost always very sensibly aided by the exhibition, 12 or more hours before, of a mercurial or other purge. In typhus and typhoid fever, scarlatina, severe erysipelas, rheumatic hyperexia, &c., after the use of the cold bath, 20 grains are often very efficacious in preventing a rapid return of the excessive fever. (*U. S. Dispensatory*, 1889.)

In the year 1866, the Madras Government appointed a Medical Commission to test the respective effiacy in the treatment of fever of quinine, quinidine, cinchonine and cinchonidine. From the Report it appears that the number of cases of paroxysmal malarious fevers treated was 2,472,—namely, 846 with quinine, 664 with quinidine, 559 with cinchonine and 403 with cinchonidine. Of these 2,472 cases, 2,445 were cured and 27 failed. The difference in remedial value of the four alkaloids as deduced from these experiments may be thus stated :—

Quinidine—ratio of failure per 1000			....	6
Quinine	,,	,,	,, ...	7
Cinchonidine	,,	,,	,, ...	10
Cinchonine	,,	,,	,, ...	23

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In 1880 a further report was made on some trials of cinchona febrifuge in quotidian, tertian, quartan and febricula. Out of 5,081 cases, 92·2 per cent. were cured. The administration of febribuge is often attended with nausea, which was supposed to be due to the amorphous alkaloid present, which is more readily absorbed in the system than the crystalline alkaloids. Purified amorphous alkaloid in small doses of two grains is very active, and has been found in Holland and in Madras to have distinct antiperiodic properties.

The Cinchona Plantations and Harvesting the Bark.—There are three Government Cinchona estates on the Nilgiris, situated at Ootacamund, Naduvatam, and Pykara. Each estate consists of one or more plantations; Naduvatam comprises Denison, Kilgraston and Napier; Pykara is composed of Hooker and Wood; and Dodabetta represents the whole of the minor plantations known under that name. The site occupied by Dodabetta is the ravine behind the Botanic Gardens, situated at an elevation of from 6,500 to 8,000 feet above sea-level, and with a mean temperature in the shade of 60° and a maximum of 70°. During the months of December, January and February the frosts are often severe, and considerable damage is done to the trees lying in the lower parts of the estate. This estate is named after the mountain, about two miles off, called Dodabetta, from Dodda (great) and Betta (hill), which is 8,642 feet above the sea, consequently the highest point on the Nilgiris, and one of the highest in Southern India. The Naduvatam estate is situated about 22 miles from Ootacamund, at the top of the Gudalur ghaut, and on the verge of the steep descent to the Wynaad plateau. The elevation varies from 5,000 to 6,000 feet, with a mean temperature of 60° in the shade, and maximum of 80° and a minimum of 54°, and an average rainfall of 105 inches. The trees grown here are Succirubras and hybrids, and several experimental plots of Calisayas, Carthagena, Santa Fé and Remijias. The Pykara estates are made up of Hooker and Wood plantations separated by the Pykara river. The elevation ranges from 5,000 to 6,200. It is estimated that the area

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covered by all these estates is 1,779 acres, the greater portion of which is under cultivation. The total number of trees in 1889 were reckoned at 1,709,656, and included the following varieties:—

Officinalis	981,919
Hybrids	655,856
Succirubras	70,693
Calisayas	273
Other kinds	915
	1,709,656

In 1879, ten years previously, the number of plants on the estates was computed at 569,031, and was composed of the following:—

Officinalis	305,432
Succirubras	260,837
Grey	1,874
Calisayas	552
Other species	336
	569,031

The *Cinchona officinalis,* yielding the Crown bark of commerce, is the chief species cultivated on the Nilgiris, and is one of the most desirable kinds for the manufacture of quinine. The Calisaya bark is the best quinine yielder of all the cinchonas, but unfortunately will not grow on the elevated sites of the Government plantations. *Cinchona succirubra* affords a bark, official in the British *Pharmacopœia,* and which obtains but little favour now in commerce. The statistics of 1879 compared with 1889 show how the red and grey bark plants have given way in the plantations to species of much greater value, such as the officinalis and the officinalis hybrid.

The outturn of bark from these estates is calculated at 100,000 pounds per annum, the whole of which has until recently been sold in London, or by public auction in the country, but within the last two years the manufacture of sulphate of quinine and other alkaloids has commenced, and

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to such an extent as to consume all the bark likely to be produced on these plantations in the future.

Besides those of Government, there are several private estates on the Nilgiris, among which might be mentioned Ossington, Devashola, Liddellsdale, and other estates at Coonoor and Kotagiri. Cinchona is largely planted in Wynaad, where an estimate of 5,000,000 plants has been reported. The species mostly cultivated are *Cinchona Ledgeriana* and *C. succirubra*, and a hybrid between these two kinds, which gives a very valuable bark containing as much as 8 per cent. of sulphate of quinine. Travancore afforded suitable sites for cinchona, and extensive tracts were planted up with Red and Crown bark varieties in the Peermaad hills and mountain districts about Devakolam, but the small remuneration accruing to the planter has caused cinchona to be neglected, and tea, as a more promising plant, is being reared in its stead.

The Darjeeling plantations of the Bengal Government are situated some 17 miles from the station of that name in the valley of the Ryang, and at Sittong in the valley of the Teesta, British Sikkim. They were commenced in the year 1862 at Rungbee, and the head-quarter buildings and factories are at Mongpoo. Some land has been opened out at Runjung in British Bhutan, but the plants have not shown so much promise as those at Sikkim, on account of the heavy rainfall in that district. The Sikkim plantations are at an elevation of from 1,400 to 5,000 feet, and occupy a tract of about 20,000 acres, only a part of which is cultivated. The Ledger cinchonas are here reared to a very large extent. Succirubra and its hybrid also grow well, and the Morada and Verde types of Calisaya have within the past few years been put out with very encouraging results. Ledgers thrive best at this latitude between 2,000 to 3,500 feet, while the Moradas and Verdes prefer a somewhat lower elevation. It has been noticed that Ledgers like a sunny aspect and Succirubras a northerly or shaded one. The plantations never reach an old age, for when the trees are 6 or 8 years old, they are cut down and uprooted, and the whole of the bark is scraped off. The plot of land is then left for a

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few years, after which it will be ready for planting up again. These plantations, therefore, possess almost unlimited tracts of the richest soil in which to extend the cultivation. The bark harvested in Sikkim differs from that of the Nilgiris in being all of one kind—namely, natural, and it is estimated that as much as 300,000 pounds can be harvested each year. In 1862 there were 311 plants. In 1875 there were 2,000 acres planted up with 3,000,000 trees from 4 to 30 feet high. At the end of the financial year 1882, there were 4,731,608 plants of the following kinds:—

Succirubras	3,873,285
Calisayas	566,695
Hybrids	291,628
	4,731,608

At this time the Darjeeling plantations were using the Succirubra bark for the manufacture of febrifuge. Recently a method has been discovered for making sulphate of quinine, hence the plantations have been adapted for the production of a larger yield of richer bark, and the statistics of the number of trees in 1889 show how this object has been attained:—

Succirubras	1,882,000
Calisayas	1,768,060
Hybrids	1,145,170
Other species	15,001
	4,810,231

The number of Succirubras has been reduced by one-half, the Calisayas have been trebled, and the hybrids quadrupled, and in this manner the alkaloid-yielding plants are being gradually replaced by those affording pure quinine.

The area of private plantations is—

Bengal	1,355 acres
Madras	6,444 ,,
Coorg and Mysore	2,000 ,,

There are four methods of collecting or harvesting the bark:—1, By taking it in longitudinal strips from the standing tree,

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and leaving the bark to renew over the exposed wood; 2, by scraping and shaving off the bark; 3, by coppicing; and 4, by uprooting. The first is that most in use in, and peculiar to the Nilgiris, having been discovered by Mr. McIvor. The trees are barked preferably in the rainy season, when the bark "lifts," or is more easily removed from the wood. The coolie inserts the point of a knife in the tree as far as he can reach and draws it down, making an incision in the bark straight to the ground; he then makes another cut parallel to the first, about an inch and a half apart, and loosening the bark with the back part of the knife, the strip or ribbon is taken off. If the operation is performed carefully, and the cambium cells are not broken, a new layer of bark will be formed in the place of that which is taken away. Other strips are taken at intervals around the stem, and the tree is then covered by moss, grass or leaves of *Phormium tenax,* and bound on by coir string or fibre. The stem is covered after the operation of stripping in order to foster the growth of the new bark (renewed bark) from the cambium, and to thicken the untouched layers of natural bark, which are now termed mossed bark. The moss which was first used to cover the partly decorticated stem is not now used on account of its scarcity, and grass, straw, leaves, tin and newspapers have been found to answer the purpose. After about two years, the trees are again visited, and if recuperation has gone on satisfactorily, the mossed bark is harvested in strips, leaving the renewed bark to thicken, and to allow a further supply of renewed bark to take the place of the mossed. The renewed bark is always of greater value than the mossed and the mossed than the natural, so long as the trees are under 20 years old, for it has been found that after that time the bark ceases to thicken, and the alkaloids remain stationary or even decrease. The bark being collected in wet weather artificial heat has to be used in drying it. Both at Naduvatam and Dodabetta there are abandoned jails where the bark is dried; fires are lighted beneath, and flues conduct the heat through the building where the bark is laid on a series of shelves. Sun heat is used at lower elevations, where other kinds of Cinchona

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are grown, and where the expense of artificial heat could not be met. The shaving process was first practised in Java, and consists in shaving off the superficial layers of bark from the whole surface of the stem, taking care that no point of the wood is laid bare. Coppicing Cinchona is to cut the tree down to a foot above ground, and to allow one or more shoots to spring up from the stool. Uprooting is adopted in the Bengal plantations, where the trees are uprooted and the whole of the bark is collected from the root, trunk and branches.

Description.—Cinchona bark is usually exported in packages, which are subjected to hydraulic pressure and arrive in the market more or less in a comminuted condition. Crown bark occurs in single quills with a blackish surface, often covered with various lichens (*Usnea, &c.*); it breaks with a fibrous fracture, and the powder of the bark is light brown. Succirubra bark is rough and warty on the outer surface, with fewer cryptogamic plants, and thicker than other kinds. It has a fibrous and splintery fracture, a reddish inner surface, and yields a reddish brown powder. Ledger bark is generally uncoated yellowish brown or whitish with black markings; the epiphlœum often falls off in flakes; the inner substance of the bark is yellowish brown, which is the colour of the powder. Root bark from all kinds of Cinchona is in the form of short recurved or twisted pieces, thicker and lighter in colour than the stem bark. Shavings consist of the outer or cellular portion of the bark, and are consequently thin and brittle, and are easily crushed in packing. Mossed bark has a dark surface, is usually free from lichen, and occurs in thick, half or single quills. Renewed bark is light in colour, easily fractured on account of the absence of much liber, and is known by the peculiar uniform smoothness of its external surface. The characters of Cinchona bark can best be studied in carefully prepared and exported samples of what is known in the market as "Druggist's bark." The character of the drug supplied to the manufacturers is of less importance than a knowledge of the amount of quinine it contains which is determined solely by chemical analysis. Indian Cinchona bark has never been

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known to be adulterated with any of the bitter indigenous drugs of the country.

Chemical composition.—The constituents of Cinchona bark of most importance are the bitter alkaloids or bases, to the first in the following list of these principles, the value of the drug almost exclusively depends.

Quinine, $C^{20}H^{24}N^2O^2$, is a light-coloured, amorphous, brittle substance in an anhydrous state, but may be obtained in a crystalline condition with $3H^2O$. It is soluble in ether, alcohol, chloroform, and very slightly in water. Aqueous solutions of the salts made with the oxygenated acids possess a blue fluorescence, and when treated with chlorine water and ammonia, a beautiful green solution is produced, known as the thalleioquin test. The solutions deviate the plane of polarization to the left. The quinine salt mostly used in medicine is the sulphate $(C^{20}H^{24}N^2O^2)^2, H^2SO^4, 7H^2O$, the theoretical centesimal composition of which is—

Quinine	74·31
Sulphuric acid	11·23
Water of crystallization	14·45

Cinchonidine, $C^{19}H^{22}N^2O$, forms colourless anhydrous crystals. The sulphate is more soluble in water than quinine, and the tartrate is very insoluble. The solutions show the same optical behaviour as quinine but to a less extent.

Quinidine possesses the same formula as quinine, and the solutions of its salts are fluorescent and afford the thalleioquin reaction; it differs, however, in deviating the plane of polarization to the right. It is separated from the other alkaloids as an insoluble hydriodate.

Cinchonine is not very soluble in ether and alcohol. The formula is the same as that of cinchonidine, but has exactly the opposite action upon polarized light.

Amorphous alkaloids, called also *Quinoidine* or *Chinioidin,* occur in all Cinchona barks and leaves. It is the name given to the preparation obtained in quinine factories, and in analysis by precipitating the mother liquors with alkali. It is a dark

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brown brittle mass softening below 100° and alkaline in reaction.

Quinamine, an unimportant alkaloid, was discovered in 1872 by Hesse in Succirubra bark cultivated at Darjeeling. Other Cinchona bases have been found and described, but as they do not occur in Indian grown barks, they need only be mentioned by name. *Paricine* in *Buena hexandra*; *Aricine and Cusconine* in false Cinchona of undetermined origin. *Pitoyine* in China bicolorata Tecamez; *Paytine* in white bark; and *Homoquinine* discovered by D. Howard and others in Cuprea bark from *Remijia* species in 1882.

The above bases are combined with Kinic and Cincho-tannic acids. *Kinic acid*, $C^7H^{12}O^6$, occurs in monoclinic prisms soluble in water and alcohol, but hardly in ether. The solutions are levorotatory. By heating it with peroxide of manganese and sulphuric acid, yellow crystals of quinone ($C^6H^4O^2$) are produced.

Cincho-tannic acid, the astringent principle of the Cinchonas, is soluble in water and spirit, and is precipitated by acids, acetate of lead and gelatine. It strikes a green colour with ferric chloride, and affords pyrocatechin by destructive distillation. Its solution in the presence of an alkali, or by boiling with dilute sulphuric acid, decomposes into an oxidized product, *Cinchona-red*, and a sugar. *Cinchona-red* occurs naturally in red bark as an amorphous substance soluble in alkaline solutions and alcohol, but neither in water nor in ether.

Quinovic acid crystallizes in scales, which are sparingly soluble in cold alcohol, more readily in hot alcohol, but insoluble in water, ether, or chloroform.

Quinovin, an amorphous bitter substance present in nearly every part of the plant, is resolvable into quinovic acid and *mannitan*. It is removed from the bark by diluted soda, from which it is precipitated with cinchona-red by an acid, from this, milk of lime dissolves out quinovin and quinovic acid, which are again precipitated by an acid, and separated by chloroform, in which the former is very soluble.

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The wax-like principle of barks has been designated by Kerner *cinchocerotin*. Hesse has found two substances of this nature; *cupreol*, $C^{20}H^{34}O$, melting at 140°C, and *cinchol* melting at 139°; they both crystallize in laminæ, but differ in optical properties.

Cultivated barks yield over 3 per cent. of mineral matter; the average of three hundred estimations was 3·42 per cent. Renewed and old natural barks are poor in ash, but scarcely, if ever, fall below 2 per cent., while young and branch barks give 4 per cent. or more. Crown bark is richer in ash than that of the red, and the red than that of the yellow. From a complete analysis of the ash of Officinalis bark, it appears that lime forms one-third and potash one-sixth of the whole, and in that of Succirubra bark, lime forms one-third and potash one-eighth of the whole. A full grown Succirubra tree has been analysed and found to contain nearly half a pound of pure lime (CaO).

Effects of Cultivation on the Alkaloids.—The alkaloids first appearing in young plants and in leaves and twigs are in an amorphous state, but as growth proceeds they become crystalline, hence it is probable that the latter are produced from the former. In diseased and dead bark and in that killed by frost, the alkaloids revert to an amorphous condition, and gradually disappear.

Trees of the same species and height, and growing under exactly similar conditions of aspect and soil, are not necessarily of the same alkaloidal value. They vary in amount of total alkaloids, but the proportion of quinine in the total alkaloids remains fairly constant for each species. This proportion averages 70 to 80 per cent. in Ledgers, 60 to 70 per cent. in Officinalis, and 20 per cent. in Succirubras. Hybridization between these plants materially affects these proportions according to the parents of the hybrid. Succirubra has influenced the Officinalis of the Nilgiris and the Ledgers of the Wynaad, forming characteristic hybrids, with their alkaloids to a very large extent taking up a mean between those of the parents. Several analysis of the Officinalis hybrid show that

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the alkaloids contain 41 per cent. of quinine in the total alkaloids, and the Ledger hybrid 58 per cent.

Ledgers and Succirubras do not much increase in alkaloidal value after 6 years of age, and therefore should not be barked when young. The Officinalis, being of slower growth, does not mature or yield the full amount of alkaloid, until the trees are at least 7 years old. The faster-growing trees appear to begin to degenerate after 15 years, and the Officinalis after 20 years.

The north or shaded side of a tree has a richer bark than that on the south side—a fact which explains the success of the mossing-system, where the bark is entirely protected from the light and heat of the sun's rays, and a larger yield of alkaloids thereby encouraged. The renewal of most barks under moss, or a similar covering, has a tendency to increase the amount of quinine at the expense of the cinchonidine, except in the case of Calisaya bark, where there is very little cinchonidine naturally existing. In the renewal of grey barks (*C. micrantha*, &c.), where no quinine or cinchonidine are found in natural bark, cinchonidine is formed at the expense of the cinchonine, which is always present in these barks in large quantity.

A large number of experiments have been made in manuring Cinchonas, and all the more important trees have been operated upon at different ages and during short and long periods. In every case the manures have increased the amount of alkaloids in the bark, and, as a rule, the increase has been in the most valuable alkaloid quinine. Manure affects the bark of young trees more quickly than that of older ones; but, on the other hand, old trees of twelve years and upwards are greatly improved by manure when it is allowed a longer time to work, about two years or more.

Some analyses of frost-bitten barks show that there is very little diminution in alkaloids when compared with natural bark analysed before the frost. It was formerly supposed that frost-bitten barks were worthless.

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The object in the Indian plantations has been to propagate those species known by analysis to contain much quinine, or if these will not grow, to raise robust trees which will yield more quinine by cultivation. Hybrids are on the increase in many estates, and by careful selection from these, the value of the future cultivation will largely depend.

The following table gives a list of the most important barks grown on the Government plantations at the present time, with a full analysis of each :—

	Quinine.	Cinchonidine.	Quinidine.	Cinchonine.	Amorphous Alkaloids.	Total.	Sulphate of Quinine.
C. officinalis, natural	2·93	1·40	·08	·42	·42	5·25	3·94
„ mossed	3·40	1·50	·20	·45	·62	6·17	4·57
„ renewed	4·21	·85	·22	·65	·70	6·63	5·66
C. succirubra, branch	1·38	2·28	...	1·59	1·16	6·41	1·85
„ natural	1·40	2·25	...	1·92	·68	6·25	1·88
„ mossed	1·69	2·08	...	1·68	·98	6·38	2·27
„ renewed......	1·84	1·48	...	1·25	·71	5·28	2·47
„ „ shavings.	2·30	1·16	...	2·06	1·45	6·97	3·09
C. angustifolia, natural......	3·97	1·32	·12	·12	·87	6·40	5·34
„ mossed......	5·60	1·41	·33	·04	·97	8·35	7·53
„ renewed ...	4·91	·89	·38	·19	1·14	7·51	6·60
C. hybrid, branch	1·64	2·71	...	1·17	·50	6·02	2·20
„ natural	3·19	2·87	...	·67	·55	7·28	4·29
„ mossed	1·92	3·16	...	·77	·35	6·20	2·58
„ renewed	4·40	2·54	...	·51	1·65	9·10	5·92
C. micrantha, branch	...	...	...	1·60	·45	2·05	...
„ natural	...	...	...	1·92	·40	2·32	...
„ renewed......	tr.	2·45	...	1·12	1·02	4·59	tr.
C. pitayensis, natural	2·34	·56	1·10	1·93	·39	6·32	3·14
„ mossed	3·81	·95	·63	1·91	·37	7·67	5·12
„ renewed	2·50	·52	·78	2·38	·55	6·68	3·36
C. Calisaya, natural	1·21	2·32	...	2·13	·29	5·95	1·62
„ branch	·59	·73	...	1·93	·48	3·73	·79
C. Anglica, natural	·81	·88	·29	1·49	·44	3·91	1·09
„ branch	tr.	tr.	·25	2·04	·36	2·65	tr.
C. Javanica, natural	...	...	1·32	2·64	·48	4·44	...
„ branch	...	...	1·48	1·49	·45	3·37	...
C. Ledgeriana, natural......	5·49	1·33	...	·82	88	8·52	7·38
„ branch	2·21	·49	...	1·07	·50	4·27	2·97
C. Humboldtiana	2·24	1·55	tr.	·49	·90	5·18	3·01
C. nitida	1·42	2·45	...	1·45	·67	5·99	1·91
C. Pahudiana	·04	·10	...	·39	·43	·96	·05
C. Carthagena	...	·40	...	1·64	1·51	3·55	...
C. Santa Fé......................	1·71	·83	...	·60	·66	3·80	2·30
C. Succirubra, Sikkim	·66	1·12	...	1·93	·77	4·48	·88
C. Ledgeriana „	2·92	·38	·11	·14	·21	3·66	3·93
C. hybrid „	2·24	2·13	...	·69	·54	5·60	3·01

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Manufacture of Alkaloids and Quinine.—The authorities in charge of the Cinchona plantations have for many years seen the desirability of extracting in the country the alkaloids so valuable in fevers and in a form that could readily be taken.

At the suggestion of Dr J. E. de Vrij, the manufacture of a light-coloured powder, consisting of the alkaloids of red bark, was started in 1874. This powder was called "quinetum" or "febrifuge," or, with reference to the locality of its production, Sikkim or Darjeeling febrifuge. Febrifuge is made by exhausting the powdered red bark with water acidulated with hydrochloric acid, precipitating the liquor with caustic soda, and drying the crude deposit. This is again dissolved in sufficient acid, reprecipitated by soda in a pure condition, filtered, dried and powdered. It has a tolerably uniform composition of Quinine 15·5; Cinchonidine 29·0; Cinchonine 33·5; Amorphous alkaloids 17·0; and colouring matter, &c., 5·0 per cent.

About three years ago, Mr. J. A. Gammie, the resident Superintendent, with the co-operation of Mr. C. H. Wood, formerly Quinologist to the Bengal Government, elaborated a method of extracting quinine from yellow bark, called the "oil process." It is called the oil process, because a mixture of fusel and kerosene oils is employed in the manufacture. The finely-powdered bark is mixed with water containing caustic soda in solution, the oils are added, and the whole is intimately agitated for a few hours and then allowed to rest. The alkaloids are then contained in the oil, which is decanted, and stirred up with water acidulated with sulphuric acid. The acid liquor now containing the alkaloids is transferred to pans and heated by steam; while still hot, the liquor is neutralized with soda and filtered, and on cooling, the solution yields the crystals of sulphate of quinine. The crude crystals are purified by dissolving them in a certain amount of hot water, filtering and cooling, and the crystals which form are collected and dried in a warm air-chamber.

Commerce.—Indian Cinchona bark began to be exported in 1867; the first three bales realized Rs. 287, and sold in London for 2 shillings per lb. From 1871 to 1886, when the export ceased,

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the Madras Government plantations sent bark to England to the extent of 31 lakhs. Red barks first sold for 2*s*. per pound and Crown barks for 3*s*. The total export from India from October 1 to September 31 was:—

1886–87......	1,286,900	lbs.
1887–88......	1,449,315	"
1888–89......	3,074,098	"

Cinchona bark is sold by the unit of sulphate of quinine. The unit is the price in pence per pound of bark containing one per cent. of sulphate of quinine. In 1885 the price of bark reached 7*d*. per unit; at the present time, 1890, it is not more than 2*d*. In 1885, a bark containing 3 per cent. of sulphate would have been worth 1*s*. 9*d*. per pound; at the present time the same bark would not sell for more than 6*d*. The fall in the price of bark has had the effect of lowering the price of the alkaloids; sulphate of quinine, for instance, last year sold for 1*s*. per ounce. The price had been gradually declining from 1877, when it was valued at 16*s*. 6*d*. per ounce in bulk.

HYMENODICTYON EXCELSUM, *Wall.*

Fig.—*Wight Ic., t.* 79.

Hab.—W. Himalaya, Deccan, Central India, Tenasserim, Chittagong. The bark.

Vernacular.—Bhaulan, Barthoa (*Hind.*), Bandárú (*Tel.*), Sagapu (*Tam.*), Kála-kadva, Bhoursál (*Mar.*).

History, Uses, &c.—Roxburgh states that the inner coat of the bark possesses the bitterness and astringency of Peruvian bark. *H. excelsum* is his *Cinchona excelsa.* Ainslie quotes Roxburgh, and tells us that the bark is used by tanners, and also as a medicine by the Hindus in cases requiring astringents. The tree yields a bitter bark in common use among the natives as a tonic and febrifuge, which was tried in the Calcutta Medical College Hospital by O'Shaughnessy, and

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found to be most valuable. In 1870, Broughton examined the fresh bark of one of the Hymenodictyons, and found that the bitter taste was due to the existence of *æsculin,* and that the bark when dry was almost tasteless owing to the transformation of that substance into *æsculetin,* the decomposition having been induced by contact with decaying organic matter. The fact here mentioned that the bark when dry lost its bitterness leads us to suppose that it was not that of *H. excelsum* but of *H. obovatum,* the dry bark of the former tree being extremely bitter.

Description.—The bark of *H. excelsum* is very bitter, and may be distinguished from that of *H. obovatum* by its red colour and bitterness. The minute structure resembles that of the Cinchonas, but the bundles of stone cells are larger, the spiral and laticiferous vessels also are more numerous, the latter being very large, and exuding when cut a waxy latex. Many of the cells are filled with a red-colouring matter as in Cinchona bark; and there is a continuous ring of stone cells near the junction of the bark with the wood. The bark examined was from branches about one inch in diameter.

Chemical composition.—From an examination of the bark made by W. A. H. Naylor in 1883, it appears that the bitter principle is not the glucoside æsculin, or its decomposition product, æsculetin, but an alkaloidal substance allied to quinoidine, berberine and paricine. From quinoidine it differs in being optically inactive, and from its double compound containing relatively less platinum. From berberine it differs in that it contains a higher percentage of carbon, while its double compound also yields a relatively larger amount of platinum. From paricine it differs only in the percentage of hydrogen it gives. Mr. Naylor considers it to be a new alkaloid having a composition corresponding to the empirical formula $C^{24}H^{40}N^{3}$, and therefore an addition to the small class of bases devoid of oxygen. Besides *Hymenodictyonine,* which is the name given to the new alkaloid, Mr. Naylor has separated a bitter neutral principle, represented by the formula $C^{22}H^{43}O^{10}$,

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which he thinks may possibly be a decomposition product of a glucoside.

In a paper read before the Pharmaceutical Society in 1886, Mr. Naylor gave the following account of further experiments made with the alkaloid hymenodictyonine:—

"On gradually adding a weak solution of iodine in ether to an ethereal solution of the alkaloid, the iodine became decolorized and a deep orange-red precipitate was formed, which quickly agglutinated and presented the appearance of a black resinous mass. By continuing the addition of iodine until it ceased to be decolorized an excess could readily be recognised. The resultant varnish-like mass was washed freely with ether, in which it was but little soluble, and then treated with hot alcohol. It was soluble to a considerable extent in cold alcohol, but its solubility increased with increase of temperature. It was hoped that by the use of a limited quantity of this solvent, acting on the compound at a suitable temperature to be ascertained by experiment, followed by a gradual process of cooling, a crystalline derivative would separate. The expectation was not realized, for the substance that separated under these conditions was always amorphous.

"The experiment was next tried of adding iodine in large excess to a solution of the alkaloid in much ether. This had the effect of producing a more flocculent precipitate at the moment of its formation, but toward the end of the reaction the several particles began to coalesce. This viscid mass was treated precisely as the previous one, and refused to be coaxed into crystallizing.

"A third attempt was made by precipitating a weak solution of the alkaloid in ether, with rather less iodine than would be required to produce complete precipitation. The precipitate was subjected to the same treatment as the previous ones, and resembled them in the granular appearances of their separations from alcohol, notwithstanding the inducement to assume some definite form offered by the varying temperatures to which they were subjected.

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"Although, after much labour and thought, I have failed to obtain an iodo-derivative in a crystalline form, I do not regard it as one of those organic principles to which the faculty of crystallization has been denied, but believe that a more perfect knowledge of the conditions of its formation in a state of purity would lead to its production. This belief is encouraged by a close correspondence to a possible formula which may be assigned to the iodo-compound prepared by the method last described. That portion of the viscid mass which dissolved in a limited quantity of hot alcohol and separated out on cooling, gave, in a series of iodine determinations by combustion with quick lime, the equivalent of 47·52 per cent. The formula $(C^{23}H^{40}N^{2})^{2}I^{3}2HI$ would require 47·92 per cent of iodine. Throughout these combustions it was observed that a fatty looking substance distilled over, having the characteristic odour of naphthaline. From solution in alcohol it crystallized in white scales.

Several attempts were made to produce a crystalline bromo-derivative, but without success. The flocculent precipitate which resulted from the reaction of ethereal solutions of bromine and alkaloid, after treatment with hot alcohol, gave on cooling a granular looking body, which was chiefly remarkable for the facility with which it parted with a portion of its bromine. A stable and definite compound was not obtained.

"The action of oxidizing agents on the alkaloid next claimed attention. The alkaloid was converted into sulphate, and to its aqueous solution was gradually added a one per cent. aqueous solution of potassium permanganate, until the liquid became permanently coloured. It was then concentrated by distillation to a small bulk and filtered. The filtrate was neutralized with sulphuric acid and evaporated to dryness. The residue was exhausted with hot alcohol, which on cooling gave a deposit and when quite cold was filtered. The filtrate was evaporated, taken up with water and converted into a silver salt, which was decomposed by sulphuretted hydrogen. Filtration, evaporation, and subsequent purification of the

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residue with alcohol and water, left a feebly coloured acid having the following properties :—

"It was markedly acid to litmus, and had a bitter after-taste. It dissolved readily in alcohol and water, and was but little soluble in ether. It united both with bases and acids. Its hydrochloride in aqueous solution when evaporated over sulphuric acid assumed an arborescent crystallization; the platino-chloride under the same conditions crystallized in plates or prisms. The acid was not precipitated with sulphate of copper, but gave with nitrate of silver a white gelatinous precipitate, which in the moist state became rapidly reduced on exposure. Lead acetate gave a white granular precipitate. Two determinations of the platinum in the platino-chloride dried at 115° C. gave 29·50 per cent. of platinum. The formula $(C^6 H^5 NO^2 HCl)^2 Pt Cl^4$ requires 29·72 per cent. of platinum, and this is the platino-chloride of a pyridine-monocarboxylic acid, *viz.*, $C^5 H^4 N. COOH$. Further, the acid, or one of its salts, when distilled with lime, yielded as a product of decomposition a volatile base which possessed the peculiar odour and general properties of pyridine. This property of the acid, coupled with its behaviour towards reagents, and the percentage of platinum in its platino-chloride, may be accepted as trustworthy evidence of its being a carboxylic derivative of pyridine. If nitric acid be used in place of potassium permanganate the same acid is obtained.

It would therefore appear that in common with the rest of the non-oxygenated alkaloids hymenodictyonine is constitutionally related to pyridine.

OLDENLANDIA CORYMBOSA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 35.

Hab.—Throughout India. The herb.

Vernacular.—Daman-pápra, Bakra, Pit-pápra (*Hind.*), Khet-pápara, Pit-pápara (*Beng.*), Khet-pápada, Pitpápada, Paripát (*Mar.*), Parpadagam (*Tam.*), Kallasabatra-sige (*Can.*), Verinella-vemu (*Tel.*), Khet-pápra (*Guz.*).

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History, Uses, &c.—This plant, called in Sanskrit Kshetraparpata, or field *Parpata*, from its frequent occurrence in cultivated fields about the end of the rainy season, is the *Oldenlandia biflora* of Roxburgh and the *O. herbacea* of De Candolle. It is frequently mentioned in Sanskrit medicinal works, and is considered a cooling medicine of importance in the treatment of fevers supposed to be caused by deranged air and bile, that is, remittent fever with gastric irritability and nervous depression. The entire plant is prescribed in decoction, and is combined with aromatics as in the *Panchabhadra*, which is a decoction of Parpata, Mustaka, Gulancha, Chireta and ginger, of all equal parts, two tolas (360 grains) being given for a day's consumption.

Rheede, who calls it *Parpadagam*, notices its use in decoction with aromatics, for spasmodic fever, and also its application as an apozem with sandalwood and honey in the same disease. It must not be confounded with the Pitpápra of the Mahometans, which is Fumitory, and is distinguished in Sanskrit as *Yavana-parpata*, or Greek *Parpata*, or with the various substitutes for that drug which are in use in India under the name of Pitta-papara.

Description.—An annual, slender herb, glabrous, rarely scaberulous, leaves linear or narrowly elliptic-lanceolate, margins often recurved, nerveless; peduncles solitary, 1 to 4 flowered, pedicel long, capillary, calyx-teeth subulate, rather shorter than the corolla-tube, crown of capsule low. It is a very variable plant, not always distinguishable from *O. diffusa* and *O. Heynii*. It varies from a diminutive straggling herb, with branches 1—2 in., to an erect one a foot and more high. Leaves from $\frac{1}{4}$ to 2 by $\frac{1}{16}$ to $\frac{1}{6}$ in., erect, spreading, or recurved, sometimes as broad as in narrow leaved forms of *O. crystallina*; stipules small, membranous, irregularly-cut, with a long and several shorter teeth or bristles. Capsule usually broad didymous, sometimes hemispheric or narrowed below the calyx-teeth, base acute or rounded, crown usually not rising above the base of the calyx-teeth, at others hemispheric and approaching that of *O. Heynii*. (*Fl. Br. India.*)

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Chemical composition.—A watery extract of this plant gave coloured precipitates with alkalies, a green reaction with ferric chloride, none with gelatine or acids, an abundant cream-coloured precipitate with lead acetate, and afforded indications of an alkaloid. A watery solution of an alcoholic extract had similar properties; it was mawkish and saline to the taste, and when evaporated to dryness it formed a mass of cubical, deliquescent crystals. A portion of this extract ignited left a saline residue consisting of potassium, sodium, and a small quantity of calcium, mostly existing as chlorides. No ammonia was detected in the herb, and the alkaloid was shaken out of an alkaline solution with ether, but had no very characteristic reactions. The value of the plant as a cooling medicine no doubt is due to the inorganic salts present. The dried herb left an unusually large incombustible residue, amounting to 22·2 per cent., very soluble in water.

Oldenlandia umbellata, *Linn., Roxb. Cor. Pl. t.* 3. Chayroot or Indian Madder.

Ainslie says:—"The small narrow, pale green leaves of this low growing plant the native doctors consider as expectorant, and prescribe them accordingly; of the virtues of the root in poisonous bites, colds and cutaneous disorders, as mentioned by Miller in his Dictionary, I know nothing. When dried and powdered the leaves are sometimes mixed with flour and made into cakes, which are eaten by such as suffer from consumptive or asthmatic affections. The dose of the decoction of the leaves is about an ounce twice daily." The root is long and slender, with a few lateral fibres, and of an orange colour. It is best known as a dyeing material. An account of its use for this purpose in India will be found in *Drury's Useful Plants of India*, 1873, pp. 240 and 470.

OPHIORRHIZA MUNGOS, *Linn.*

Fig.—*Gärt. Fruct. i., t.* 55.

Hab.—Mountains of Assam, Western Peninsula and Ceylon. The root and plant.

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Vernacular.—Kiri-purandán (*Tam.*), Sarpáshi-chettu (*Tel.*), Rásna, Nákuli (*Hind.*), Nanjáre, Rashme (*Can.*), Rásna, Mungusvel (*Mar.*), Mungusvel, Nákuli (*Guz.*).

History, Uses, &c.—This plant is described in Sanskrit in the following terms:—

Nákuli, Surasá, Rásná, Sugandhá, Gandhanákuli,
Nákuleshtá, Bhujangákshi, Chhatrica, Suvaha, Nava.

The fifth and sixth synonyms signify that its odour is agreeable to the Nákula, and the seventh that it is offensive to snakes.

It was first brought to the notice of Europeans by Garcia. Kæmpfer, who calls the root *Radix Mungo* (*Amœn.* 573 and 577), says of it:—"Radix est, plantæ Malaicé *Hampaddu Tanab*, id est, *Fel terræ* dicta, á sapore amarissimo omnium feré partium, præsertim radicis, quæ intensam bilis amaritiem exhibit, Lusitanis ibidem *Raiz* seu radix *Mungo* appellata, á mustela quadam seu viverra, Indis *Mungutia*, Lusitanis ibidem *Mungo*, Batavis *Muncus*. Garciæ ab Hort, (*Ar. Hist. L. i., c.* 44.) *Quil* et *Quirpele* appellata, quæ radicem monstrasse, et usum ejus pro alexipharmico prima mortalibus prodidisse creditur. Est mustelæ huic is genius, ut serpentem naturali odio prosequatur; et velut glirem catus invadat. Tradunt igitur, si contingat morderi muncum, serpentis astutia roboreve victum, relicto hoste, pro alexipharmaco hanc radicem quærere, et esu ejus illico restitutum, certamen redintegrare. Sit fides rei penes indigenas. Hoc tantum de mustela hac exploratum habeo, morsam á vipera, vel luctu fatigatum, dimisso victore, ex palæstra in campum excurrere et obvias depascere herbarum radiculas, mox pastu, ut opinor refectam, rursus comparere ad certamen, cum hoste, si adsit, redauspicandum." Kæmpfer also says that the plant to his knowledge grows in Java, Ceylon, and Sumatra, is a foot or more in height, and not unlike the lesser Centaury. It has a single root, a span in length and as thick as the finger, much contorted, with a rough, brown, closely-adhering corky bark, and a hard, white fragile woody column; it has a bitter taste like Gentian but

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more delicate and agreeable. (*Op. cit.*, p. 577.) The supposed alexipharmic properties of this plant have long since been disproved, but it appears to be an agreeable bitter tonic.

Description.—A small shrubby plant, 1 to 1½ foot; stems hard and woody, bark light brown and corky; leaves opposite, elliptic-lanceolate, acuminated at both ends, glabrous, very thin, unequal in size, 2—5 by 1—2½ in., calyx-tube turbinate, limb 5-cleft; corolla-tube infundibuliform, short, hairy within, limb 5-lobed; stamens enclosed; capsule compressed, crowned with the calycine segments, 2-celled, 2-valved; seeds numerous, somewhat hexagonal; cymes peduncled, terminal, branched; flowers nearly sessile, white. The root consists of several hard, woody, contorted branches, about six inches in length, covered with a thin brown bark. The lower portions of the stem are generally collected along with the root, and to these Kæmpfer's description appears more particularly to apply, as the root-bark can hardly be described as corky. Taste moderately bitter.

Chemical composition.—A decoction of the root contained starch but no astringent matter. An alcoholic extract evaporated to dryness was a mixture of some green fatty oil containing chlorophyll, and a light brown resin which remained as yellowish red flakes when water was added. The resin was tasteless, and gave a blood-red colour with caustic soda and red with sulphuric acid; it dissolved in chloroform and other volatile solvents, but showed no disposition to crystallize on gentle evaporation of these solutions. The filtrate from the resin was sweet and demulcent and afterward bitter, shaken up with ether it yielded a resinous substance to that solvent. The liquid treated with ammonia and then shaken with ether, yielded up no alkaloidal body, but a white granular scum remained on the stratum between the two liquids; benzol added and agitated with the alkaline liquid separated the bitter alkaloid in an amorphous condition, the quantity however was too small to admit of anything approaching a complete analysis.

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MUSSÆNDA FRONDOSA, *Linn.*

Fig.—*Wight Ill. t.* 124; *Rheede Hort. Mal. ii., t.* 18.

Hab.—Tropical Himalaya, Western Peninsula. Leaves, fruit, flowers and root.

Vernacular.—Bebina, Sribar (*Hind.*), Srivadi (*Mal.*), Vella-ellay (*Tam.*), Srivar, Srivardoli, Bhútkes, Lavasat (*Mar.*), Asari (*Nipal*).

History, Uses, &c.—This is a well-known scandent shrub, and easily recognised by its orange-coloured flowers, which contrast prettily with the white calycine leaf, making it a very remarkable object. All the flowers do not produce this leaf-like sepal, but two or three in each corymb, and occasionally two sepals are thus developed. *M. frondosa* is called Srivati in Sanskrit, and is a favourite of the goddess of fortune, from its bearing the white mark of Vishnu or Krishna; another name for it is Nagavalli. Among the Tamil people it is called the "white-rag plant." The flowers are used in country places to make the garland which is tied over the doorway on festive occasions. The root in 80-grain doses is given with cow's urine as a remedy for jaundice (pandu-roga), or two tolas (360 grains) of the white leaves may be given in milk. The juice of the leaves and fruit, which is very mucilaginous, is used as an eye-wash. Rheede says:—The root in decoction expels phlegm, externally applied it is cooling, boiled in oil it cures aphthæ. According to Loureiro, the flowers are attenuant and diuretic, and are used in cough, asthma, ague, and flatulence; externally applied they clean foul ulcers, and cure skin eruptions. In Mauritius a species of Mussænda is called "wild cinchona" and is used as a tonic.

Chemical composition.—A bitter principle, having the peculiarities of a glucoside, pervades all parts of this plant. It was soluble in water and rectified spirit, afforded a reddish brown colour with sulphuric acid, passing from a fine red to a purple, and was not precipitated by alkaloidal reagents or by tannin. Evaporated with an excess of hydrochloric

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acid, the purple colour was developed, and boiled with the acid, the bitterness of the solution was reduced, a brown decomposition product separated, and the filtrate readily reduced Fehling's solution. The taste was very bitter and acrid, and the glucoside was not obtained in crystals. The aqueous solution of the ether extracts of the various parts of the plant contained a yellow colouring matter related to the quercitrin group, and a colouring matter of the nature of an organic acid was present in the alcoholic extracts, precipitated by acids, and redissolving with the formation of an orange colour in alkalies.

A proximate analysis was made of the white calycine leaves, the fruits, the green leaves, and the mixed stem and root barks. On comparing these results, there is seen to be a correspondence on the one hand between the composition of the calycine leaves and fruits, and on the other hand between that of the green leaves and bark,—results which might naturally be expected, seeing that the calycine leaf is merely an expansion of the ovary-coat, and the leaves act the part of elaborating principles to be stored up in the bark and root.

	Calycine leaves.	Fruit.	Leaves.	Bark.
Ether extract	4·3	8·8	5·0	15·7
Alcoholic „	28·7	27·3	15·1	17·3
Aqueous „	11·5	13·4	13·8	9·4
Crude fibre	32·4	33·2	38·3	39·3
Albumen, &c. by difference	15·1	8·5	16·4	7·0
Ash..........................	8·0	8·8	11·4	11·3
	100·0	100·0	100·0	100·0

The bark contained the largest quantity of ether-soluble resin, which was yellow, opaque, tasteless and very tenacious. In the leaves the resin was associated with a fat, and in the calycine leaves with a wax. The fruits and calycine leaves contained larger quantities of sugar than other parts of the plant, as seen in the figures for the alcoholic extracts. The aqueous extracts contained mucilage and colouring matter, the former predominating in the leaves and fruits. The

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albuminous matter was most abundant in the expanded parts of the plant.

The fruits were specially examined for alkaloids, but with negative results; they were much more bitter and acrid than the leaves, and would not be acceptable as an article of diet. Notice has recently been taken of an article called "Mussænda coffee" found in the isle of Réunion; but an investigation of the subject proved that the fruits and seeds were those of *Gærtnera vaginata*, a loganiaceous plant, and that chemically they were destitute of an alkaloid. (*Kew Bulletin*, December 1889).

RANDIA DUMETORUM, *Lam.*

Fig.—*Lam. Ill. t.* 156, *f.* 4; *Wight Ic. t.* 580; *Roxb. Cor. Pl. t.* 136.

Hab.— Throughout India. The fruit.

Vernacular.— Mainphal, Mindhla, Pinda (*Hind.*), Mindhal (*Guz.*), Gela, Gelaphal, Peralu (*Mar.*), Menphal (*Beng.*), Marukkallán-kai (*Tam.*), Mangáre-bongáre (*Can.*).

History, Uses, &c.—Mainphal is described by Sanskrit writers under the name of Madana as pungent and dry, and beneficial in leprosy and phlegmatic swellings, the best or safest of emetics; one ripe fruit is said to be a sufficient dose; emesis is generally promoted by a drink containing bitters and aromatics. It is indispensable at the marriage ceremonies of the Vaisya caste, being tied upon the wrists of both bride and bridegroom along with the fruit of *Helicteres Isora.* The Mahometan physicians of India have adopted it as a substitute for the Jouz-el-kai of the Arabs; they describe it as an emetic which expels bile and phlegm, at the same time acting as an aperient; it should be administered in combination with aromatics and honey. Ainslie says:—"The Vytians consider it amongst their best emetics, and prescribe it in the quantity of about one pagoda weight. It is given commonly in the form of powder, the whole nut, seeds included, being powdered." An infusion of the bark of the root is administered to nauseate in

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bowel complaints. Roxburgh in his Coromandel Plants observes that the nut bruised and thrown into pools where there are fish intoxicates them, in the same way that *Cocculus Indicus* does. This practice may be observed in the Concan, where the fruit is well-known as a fish-poison, and is also mixed with corn to preserve it from insects. Mr. Moidín Sheriff, in his *Supplement to the Pharmacopœia of India,* says:—"It is certainly not a good emetic if used as is generally done by powdering the whole nut. The thick shell and the numerous hard seeds are not emetic at all; indeed, if anything they are slightly irritant; only the dry pulp or mucus, which is the least part of the nut, possesses emetic and nauseant properties. The contents of two to three nuts are generally à sufficient dose; they should be bruised, macerated for ten or fifteen minutes in three to four ounces of water, rubbed and strained through cloth. The draught is now ready for use, and produces nausea and vomiting in about ten minutes; emesis should be promoted by the administration of warm water. The ejected matter contains a large quantity of frothy mucus." Mr. Sheriff has found the drug a good substitute for Ipecacuanha in dysentery. He recommends the powdered pulp as the most convenient form for administration. Dose, 40 grains as an emetic; 15 to 30 grains in dysentery, according to the severity of the disease. In colic the fruit is rubbed to a paste with rice water and applied over the navel.

Description.—The dried fruit is about the size of a crab apple, globular or oval, reddish brown, crowned with the rim of the calyx, and in a fresh state has a strong odour of recently tanned leather. It consists of a pericarp and shell, which contains the seeds embedded in pulp. The shell is hard and thick, 2-celled, the dividing septum being thin and membranous. The pulp is grey, and has a nauseous taste and smell. The seeds are small and oblong, about 1½ lines in length, slightly flattened, very hard and of a brown colour, and 100 on an average are contained in each fruit. The average weight of the fruit is about 60 grains, of the pulp separated from the seeds 15 grains.

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Microscopic structure.—The greyish pulp surrounding the seeds is composed of large oval cells containing a little granular matter. The pulp of the pericarp is remarkable for numerous large reddish-brown stony cells. The epidermis is formed of tessalated cells of irregular size and shape. The albumen of the seeds is horny and translucent.

Chemical composition.—The active principle of the fruits is saponin, which forms a large proportion of the pulp surrounding the seeds. The fresh pulp was mixed with water and the juice expressed; the filtered liquor had the following properties:—It was acid in reaction and very frothy, it gave opaque white precipitates with diluted mineral acids, a greenish colour and transparent jelly with ferric chloride, a yellow colour with caustic soda, no reaction with iodine, and no precipitate with two volumes of rectified spirit. Acetate of lead caused such a thick mixture as to allow the vessel to be inverted without the contents flowing out. A measured quantity of the solution, representing a weighed quantity of the dried pulp, was boiled for one hour with dilute HCl, after which the insoluble sapogenin was weighed and the increase of glucose was determined in the filtrate. Calculations from these results showed that the pulp contained about one-third its weight of saponin, and that on an average about four grains of this principle existed in each fruit.

An extract was also obtained by exhausting the pulp with hot spirit and evaporating the united liquors to dryness. This extract was soluble in water, except a little waxy matter, and the solution was acid and frothy. It gave a green coloration with ferric chloride, turning red with ammonia, yellow precipitates with barium hydrate and the acetates of lead, a red colour with caustic soda, and negative reactions with gelatine and iodine solutions and alkaloidal tests. This solution gave a precipitate when boiled with dilute acid, and showed an increase in glucose corresponding with that obtained in the decomposition of saponin. Evaporated portions of the solution produced a purple colour in contact with strong sulphuric acid.

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The pericarp contained some of the principles peculiar to the pulp, such as saponin, wax, resin and colouring matter, and in addition a volatile odorous body of the nature of a soluble fatty acid, which was obtained by distillation and formed soluble salts with silver and barium. A portion of the distillate was neutralized with caustic soda, and carefully evaporated to dryness. The residue was crystalline, deliquescent, soluble in rectified spirit, and sweetish to the taste; treated with sulphuric acid the odour of valeric acid was liberated, and this acid no doubt existed in the pericarps of the fresh fruits in a free state.

The unripe fruits of **Randia uliginosa**, *DC., Wight Ic. t.* 397, are astringent; roasted in hot ashes they are used as a domestic remedy for diarrhœa and dysentery. When ripe they are cooked and eaten as a vegetable. They are of a yellow colour, and have the appearance of a small pear. The structure of the fruit is similar to that of *R. dumetorum.* It is called Pindálu or Pedalu in Hindi, Pinglu in Guzarathi, Chuvadialu or Piralu in Bengali, Pendhári Pendhru or Péndhar in Marathi, Nalaika in Telugu, Wagata in Tamil, Karé in Canarese, and Pindálu or Pindáluka in Sanskrit; and is described as sweet, cooling, and diuretic.

GARDENIA GUMMIFERA, *Linn. f.*

Fig.—*Thunb. diss. Gard., t.* 2, *f.* 3.

Hab.—Western Peninsula, Chittagong, Burma. The resinous exudation.

Vernacular.—Dikamáli (*Hind., Guz.*), Dikémáli (*Mar., Can.*), Kumbai, Dikamali (*Tam.*), Tella-manga, Chiaka-ringuva (*Tel.*).

History, Uses, &c.—This remarkable substance is supposed to be the Nadi-hingu, Hingu-nádika or Pindahva of Sanskrit writers, and is used by the Hindus in fever, dyspepsia, flatulence, and chronic skin diseases. In veterinary practice, it is much used to keep flies from sores, and some European physicians have used it to expel round worms with success.

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G. lucida yields a similar exudation, and Roxburgh states that the fruit of *G. campanulata* is used as a cathartic and anthelmintic, and to remove stains from silk. In the Concan, the root of *G. florida*, rubbed into a paste with water, is applied to the top of the head as a remedy for headache during pregnancy, and is also given internally in hysteria, alone, or combined with *Bharangi* (*Clerodendron serratum*).

Description.—Commercial Dikamali occurs in the form of irregular flat cakes, of a dull olive green colour, more or less mixed with bark, sticks, and the leaf-buds of the plant. The odour is peculiar and offensive, like that of cat's urine. The resinous exudation, if carefully collected from the leaf-buds, is transparent and of a bright golden yellow; it dissolves rapidly in rectified spirit, forming a solution of the colour of pale sherry, which, when poured into water, forms a delicate primrose-coloured emulsion. This after standing for 24 hours deposits a portion of the resin in an opaque condition, and of the colour of precipitated sulphur, but not in sufficient quantity to visibly affect the colour or opacity of the emulsion.

Chemical composition.—Dikamáli contains two resins, one soft and of a greenish colour, the other crystalline and of a golden yellow. The latter was discovered by Stenhouse (*Phil. Trans.* 1856, *CXLVI.*, 155, and *Ann. Chem. Pharm. XCVIII.*, 316), but the amount of *gardenin* obtained at that time was insufficient for a satisfactory analysis. Stenhouse and Groves operating with a larger quantity of the resin found that the best method of obtaining the crude gardenin was to boil the resin with alcohol, filter the solution to separate the insoluble residue, consisting chiefly of small fragments of bark and wood, and allow it to cool. It then deposited almost the whole of the gardenin in slender pale yellow needles, which were collected and washed with cold spirit, to free them from the amorphous greenish yellow resin, which forms by far the larger portion of Dikamáli gum. These needles, however, even after several crystallizations from alcohol, were found to be still impure, being contaminated with a colourless substance

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of low-melting point, somewhat resembling a fat in appearance. After repeated trials in various ways, it was found that this impurity might be removed by means of light petroleum. A boiling saturated solution of the gardenin in alcohol was allowed to cool, and the almost pasty mass of crystals was agitated with light petroleum at a temperature of about 30°, the clear liquid poured off, and the residue again agitated with petroleum, repeating the operation several times. The gardenin was finally purified by alternate crystallization from hot benzine in which it is readily soluble, and from alcohol.

When pure, gardenin forms brilliant deep yellow crystals, which melt at 163° to 164°. Dried at 100°, and burnt in a current of oxygen, it gave the following results:—

I. 0·249 gram. of substance gave 0·567 gram. carbonic anhydride, and 0·119 gram. of water.

II. 0·202 gram. of substance gave 0·457 gram. carbonic anhydride, and 0·102 gram. of water.

	Theory	I.	II.	Mean.	Flückiger.
C5.........60	61·86	62·12	61·70	61·91	59·47
H5......... 5	5·16	5·31	5·60	5·45	6·71
O2.........32	32·98	......	......	......	......
97	100·00				

Flückiger's numbers do not agree with these, but as the specimen he analysed had merely been purified by repeated crystallization from spirit, it is not impossible that it was contaminated with traces of the colourless fatty substance mentioned above. This is rendered very probable by the much lower melting point (155°) which he obtained. It was stated in the earlier paper (Stenhouse *loc. cit.*), that when gardenin is digested with concentrated nitric acid, it is rapidly decomposed, picric acid, but no oxalic acid, being produced. On repeating the experiment, however, this statement was found to be incorrect; gardenin when boiled with nitric acid, dissolves with evolution of nitrous fumes, forming a yellow solution, which on evaporation leaves a yellowish residue; this, however, on careful examination, proved to be quite free from

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trinitrophenol. It was noticed in making this experiment, that at the moment the gardenin came in contact with the nitric acid, it assumed a brilliant crimson colour before dissolving. The attempts made to isolate the red substance thus formed were ultimately successful; one part of gardenin was dissolved in about thirty times its weight of boiling glacial acetic acid, and after being rapidly cooled two parts of nitric acid of sp. gr. 1·45 were added to the clear solution. In a few seconds hair-like crimson needles began to form, very different in appearance from gardenin. At the expiration of five minutes, the mixture, which was kept cold, had solidified to a pulp of needles. It was then mixed with about 150 parts of cold water, and the gelatinous precipitate collected after it had stood a few minutes. The pasty red mass, after being well washed, was pressed into a cake and dried. Gardenin yields nearly 90 per cent. of its weight of this substance, which is insoluble in water and dilute acids, but readily soluble in alkaline solutions, and reprecipitated on the addition of an acid. It has been provisionally named *gardenic acid.* It is free from nitrogen, and after being purified by boiling with spirit, in which it is but very slightly soluble, and crystallization from glacial acetic acid, it was found to melt at about 236°. (*Phar. Jour. and Trans., July* 21*st,* 1877.)

Commerce.—Dikamáli is collected by hand, the leaf bud with the drop of resin attached to it being broken off. It is sometimes made into circular cakes of about a pound weight; at other times it occurs in large irregular masses, often very impure. Value, Rs. 3-12 per maund of 37½ lbs.

Canthium parviflorum, *Lam.,* a small thorny shrub of the Western Peninsula and Ceylon, called *Kirni* in Marathi and *Karai-cheddi* in Tamil, is noticed by Ainslie as having medicinal properties. He says:—"A decoction of the edible leaves, as well as root of this plant, is prescribed in certain stages of flux, and the last is supposed to have anthelmintic qualities, though neither have much sensible taste or smell." (*Mat. Ind. ii.,* 63.) This shrub is best known for its edible

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fruit, which is an obovate compressed drupe of a reddish-brown colour about the size of a horse bean; it is sweet, and contains two seeds.

Canthium didymum, *Roxb. Mallea, Varsangi* (*Mar.* *Naum-pápala* (*Tel.*), has leaves which smell like coriander. The pounded bark is applied by the natives to fractures.

These plants have really little, if any, medicinal qualities.

Vangueria spinosa, *Roxb.*, is the *Pinda* and *Pinditaka* of Sanskrit writers, who consider the fruit to be medicinal, and describe it as strengthening, cooling, and an expellant of phlegm and bile. It is a small tree or large bush, common in many parts of India, from Northern Bengal to Canara, which bears cymes of greenish flowers; the fruit is a drupe, the size of a cherry, of a yellow colour when ripe, subglobose or turbinate, smooth and fleshy, pyrenes 4 to 5, woody, smooth.

The vernacular names are Pundrika, Pinditak (*Hind.*), Mayna (*Beng.*), Pedda-manga (*Tam.*), Vadanike, Chega-gadda (*Tel.*), Chircholi, Madanvriksh (*Mar.*), Maggare-gida (*Can.*).

PAVETTA INDICA, *Linn.*

Fig.— *Rheede Hort. Mal. v., t.* 10; *Wight Ic., t.* 148.

Hab.— Throughout India. The root and leaves.

Vernacular.—Kukura-chura (*Beng.*), Pápari, Kankra (*Hind.*), Pavuttay-vayr (*Tam.*), Páputta-vayroo (*Tel.*), Pápadi (*Mar.*), Pappadi (*Can.*).

History, Uses, &c.—This shrub, which is common on hilly ground, is called Pápata and Tiryakphala in Sanskrit. It is the Malleamothe of Rheede, who says that the leaves are used as manure, and a decoction of them as a fomentation, and that the root with ginger is given in dropsy. Ainslie says:—"This is a bitter but not unpleasant tasted root, possessing at the same time aperient qualities, and is one of those medicines commonly prescribed by the native doctors in visceral obstruc-

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tion; given in powder to children, the dose is about a drachm or more.

Description.—The root is crooked, from 1 inch to ¼ inch in diameter. The bark is grey, with a light brown papery epidermis, and seems to be the most active part. It has a sweetish aromatic taste followed by a bitterness. A section placed under the miscroscope shows large laticiferous vessels, containing a greenish latex, and a parenchymatous structure containing many small starch granules. It is not an article of commerce.

Chemical composition.—The powder gave off a pleasant odour when boiled with water, and a greenish resinous scum separated on the surface of the liquid. The decoction showed the presence of starch, the absence of tannin, and contained a coloured organic acid. Alcohol removed the active bitter principle of the root, and after separating the resin by precipitation with water, the solution when evaporated was perfectly crystalline. The residue was insoluble in ether, but boiling chloroform formed with it a solution from which the bitter principle separated on cooling in white transparent needle-shaped crystals. These crystals were very soluble in water and alcohol, and reduced Fehling's reagent. With sulphuric acid they turned reddish brown, changing to violet; with Fröhde's reagent crimson, changing to green. Warmed with diluted sulphuric acid and potassium bichromate they gave off the odour of salicylol. They melted at 120° C. to an amber-coloured liquid, at a higher temperature to a rich red-brown colour, further heating carbonized them, and inflammable smoky vapours were given off leaving no ash. This bitter glucoside is closely related to salicin, but differs from that substance in its optical inactivity and its greater solubility in water.

IXORA COCCINEA, *Linn.*

Fig.—*Wight Ic.*, *t.* 153; *Bot. Reg.* 513 *and* 154. Jungle Geranium (*Eng.*).

Hab.—Western Peninsula. Cultivated elsewhere.

Vernacular.—Rangan, Rajana (*Beng.*, *Hind.*), Bakura, Pentgul (*Mar.*), Vitchie (*Tam.*).

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History, Uses, &c.—The shrub is sacred to Shiva, and Don is probably correct in stating that the generic name is derived from that of a Malabar idol. The Sanskrit word Ishvara, which signifies god, and especially Shiva, would be written Ixora in Portuguese, and nothing can be more probable than that the first explorers of the Malabar Coast, on learning that the plant was sacred to Ishvara, should name it after that god. In Southern and Western India the Hindus use the bright red flowers, probably in accordance with the doctrine of signatures, as a remedy for dysentery. In the Concan they are fried in melted butter, rubbed down with a little cumin and nágkesar (cinnamon buds), and made into a bolus with butter and sugar-candy. In Southern India they are given with tyre or goat's milk. Rheede notices the use of the root in fever and gonorrhœa, also its external application in headache, and to boils, with or without cocoanut milk. The root was brought to the notice of the profession a few years ago as a remedy for dysentery by a medical man in Bengal, but Dr. F. Willis reports:—"I tried it in many cases, but only in a small number did I find it of any benefit, one case only was cured without other drugs; it is, however, a very good stomachic tonic, useful in cases of debility of that organ, and that I think is its proper place in therapeutics."

Description.—Root branched, ¼ inch or more in diameter; bark thick, smooth, brown, marked with small warty prominences, it exudes a yellow juice when cut; wood hard, yellowish; odour rancid and disagreeable. Commencing from the exterior the bark, when viewed under the microscope, presents several rows of brick-shaped cork cells of a brown colour; the parenchyma is loaded with starch cells, and permeated towards the inner part by yellow laticiferous vessels, just without these is an interrupted zone of yellow stone cells. The wood is porous with strongly marked medullary rays.

Chemical composition.—The root had no peculiar taste, but a slight odour of volatile fatty acids developed on boiling the powdered root with water. Ether separated a yellow oily

liquid, the aqueous solution of which was very acid and had an odour of butyric acid. A tincture of the root was red in colour, astringent to the taste, and very acid in reaction. Evaporated to dryness and heated with water, the solution gave evidence of a tannin by giving a green precipitate with ferric chloride, pinkish with gelatine and bulky brown with iodine. The insoluble portion yielded to petroleum spirit one or more fatty acids, liquid at 20° C., and the red precipitate insoluble in this medium was soluble in spirit and soda solution, and consisted of oxidized tannin. A white crystalline substance was associated with the tannin in the aqueous solution of the alcoholic extract, and gradually formed in small quantity when the evaporated solution was set aside for a few days. The flowers have the delicate odour of cinchona flowers, and contain a colouring and astringent principle of the nature of an organic acid. The red colour is imparted to water more readily than to alcohol, but the latter separates it in a purer condition. The aqueous solution is blackened by ferric chloride, precipitated by gelatine, destroyed in brilliancy by fixed alkalies and restored by acids. Ammonia renders the solution dichromatic, and lead acetate throws down the colouring matter as a greenish blue precipitate, containing 32·9 per cent. of oxide. Ether removes a wax and a yellow colouring matter related to quercitrin. Alcohol and water respectively remove from the drug the same amount of extract, namely, 30 per cent., consisting largely of saccharine matter. The astringent colouring matter occurred to the extent of 5·7 per cent., and the papers used in filtering the solutions retained a small quantity of the colour, which changed to blue by exposure to the air, and this paper acted as litmus in turning red with the least trace of acid. The ash was 6·4 per cent.

The flowers of **Ixora parviflora**, *Vahl.*, the Torch tree, pounded in milk, are given for whooping cough, and at the same time a necklace of the flowers is worn. This evergreen shrub or small tree is common in many parts of India, and the Dâk (Post office) runners make torches of it. The vernacular names are Kotha-gaudhal (*Hind.*), Rangan (*Beng.*), Raikura

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Mákadi (*Mar.*), Gorabikattige (*Can.*), Shulundu-kora (*Tam.*), Kachipadel (*Tel.*).

COFFEA ARABICA, *Linn.*

Fig.—*Bot. Mag., t.* 1303; *Bentl. and Trim.* 144. Coffee bush (*Eng.*), Cafeier (*Fr.*).

Hab.—Africa. Cultivated elsewhere. The seeds.

Vernacular.—Kahvah (*Arab., Ind. Bazars*). Corruptions of the English name are now in general use among the natives.

History, Uses, &c.—The plant is a native of tropical Africa; it grows gregariously in woods at an elevation of 1,000 to 2,000 feet or more. It is common in Abyssinia, whence it was introduced into Arabia by the Arabs, and through them the seeds became known to the Persians and Turks. The date of the introduction of coffee into Arabia is uncertain, the first Arabian writer who mentions *bunn* (coffee berries) is Firuzabadi in the Kámus, which work was, according to the original copy, written by himself, completed A.H. 768 (A.D. 1366). He describes *bunn* as a certain thing which is taken like the condiments termed مرى (murriye). Ibn-es-Simani says, "It is a thing reckoned among what are termed كوامخ (kawámíkh) which signifies the same as Murriye. The physician Dawood, says: "It is the produce of a certain tree in El Yemen, which grows to the height of about three cubits, on a stem of the thickness of the thumb, and has a white flower, which is succeeded by a berry, like the hazel nut; sometimes it is cut like beans; and sometimes, when it is divested of its covering, it divides into two halves: it has been proved to be good for alleviating humidities and cough and phlegm and defluxions, and for opening obstructions, and causing a flow of the urine: when roasted (and pounded or ground) and well cooked (*i.e.*, boiled in water), it is now commonly known by the name of قهوة (kahvah)." (*Lane, in Madd-el-Kamus.*) Kahvah in Arabic signifies 'wine' or 'that which causes appetite,' and, before coffee was known to the Arabs, was applied to some other stimulating drink (probably kât), which they were in the habit of

using. Coffee is not mentioned by Haji Zein-el-Attár, who wrote in A.D. 1368; consequently, it cannot have been known in Persia at that date. Though coffee was known to the Arabs as a medicine in the 14th century, coffee-drinking does not appear to have been practised until the early part of the 15th century, when, according to some authorities, Jamal-ed-deen Abu Abdulla Muhammad bin Said-ed-Dubáni, Kadi of Aden, returning from Abyssinia, where the practice is said to have existed from a very early date, introduced it at Aden, whence its use gradually spread through Arabia to Persia and Turkey. Another account of its introduction as a drink in Arabia is that the disciples of Sheik Abul Hasan Shadali, who had a cloister on the mountains of Yemen, being much worn out by fasting and constant vigils, accidentally ate some of the berries of a coffee bush, and finding them very refreshing, told the Sheik of their discovery, upon which he ordered them to use a decoction of the fruit as a drink. When first introduced the practice of coffee-drinking met with much opposition both in Arabia and Persia, and its use was prohibited by some of the Mahometan law doctors. A Persian rhymster says of it:

آن سیه رو که نام او قهوه است .:. مانع النوم و قاطع الشهوه است

i.e.—That black-faced drink called coffee is the preventer of sleep and destroyer of manhood. On the other hand, its admirers were not silent, as will be seen from the following lines:—

راحیست قهوه روح فزا و کسل گسل .:. آرام جان و قوت اعضا و قوت دل
تقریب اجتماع جوانان پارسا .:. تفریح بخش خاطر پیران مضمحل

Coffee is a wine which induces a feeling of well-being and case;
It soothes the mind and strengthens the limbs and heart.
It ministers to the pleasures of the youth of Persia,
And alleviates the pangs of decrepid old age.

According to Indian tradition the Coffee plant was introduced into Mysore by a Bábu or wandering monk, named Abu-din, who about A.D. 1650 came and took up his abode on the uninhabited hills in the Nugger division, named after him, and where he established a college, which still exists, endowed by the Government. It is said that he brought seven

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coffee berries from Mocha, which he planted near his hermitage, about which are now to be seen some very old coffee plants. (*Drury.*)

Coffee-drinking was introduced into India by the Persian invaders, but its use appears to have been confined for a long time to the entourage of the Moghal Court, as Linschoten, who was in India from 1576 to 1590, does not mention the berry among the articles of trade found in the Portuguese Settlements in the East. Rauwolff is the first European writer who notices it, having observed its use at Aleppo in 1573. In 1592, Prosper Alpinus published a figure and description of the plant from a cultivated specimen he saw in a garden in Egypt. For some time after this, Cahué, Coffa, or Kauhi as it is written in an Arabic and English pamphlet printed at Oxford in 1659, appears to have been known by name only to the learned in Europe, as Burton in his *Anatomy of Melancholy*, which was published in 1621, says, "The Turks have a drink called coffee (for they use no wine), so named of a berry as black as soot, and as bitter (like the black drink which was in use amongst the Lacedæmonians, and perhaps the same), which they sip still of, and sup as warm as they can suffer," &c.

Coffee-drinking began to be practised in Western Europe by Turkey merchants in 1650, and in 1652 it was introduced into London, when one Pasqua Rosee, the Greek servant of a Turkey merchant named Edwards, opened a house to sell it publicly in St. Michael's Alley, Cornhill. There appears to have been much prejudice for a long time against *the Turkish berry as black as soot and as bitter,* as in 1663 a poetical satire, entitled *"A Cup of Coffee or Coffee in its colours,"* appeared, in which it is stigmatized as—

> "A loathsome potion, not yet understood,
> Syrop of soot, or essence of old shoes,
> Dasht with diurnals and the book of news."

And in the "Women's Petition against Coffee," 1674, they complained that "it made men as unfruitful as the desert whence that unhappy berry is said to be brought." As late as 1711, we find the following passage in a letter written by

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Charlotte Elizabeth from Marly to her step-sister in Germany: "I am grieved to learn, dear Louise, that you have taken to coffee; nothing is so unhealthy, and I see many here who have had to give it up because of the diseases it has brought upon them. The princess of Hanan died of it in frightful sufferings. After her death they found the coffee in her stomach, where it had caused several ulcers. Let this then be a warning to you."

Coffee is cultivated by the Arabs in the lower valleys of the mountains of Yemen, the plant is watered regularly morning and evening, and takes three years to arrive at maturity, when it forms a shrub from 7 to 11 feet in height. A good bush of *Oudanee* coffee produces 28 lbs. yearly. The beans are brought in December and January to Sanaa, from the surrounding districts. They are divided into seven classes, as *sherjee*, the best; *oudanee*, the largest, &c. From Sanaa they are carried to Mocha and Hodeida. The people of Sanaa never use the coffee bean, but employ the husk, which they call "*Khishr*," and which is prepared in the same manner; they say that the bean is too heating, but that kishr is an infallible remedy for all disorders. (*C. J. Cruttenden, Trans. Bom. Geograph Soc. ii.*, 45, 1836.) Cruttenden notices the difficulty experienced by the merchants in forwarding their coffee to Mocha, owing to the Turks having taken possession of the Tehama, and shortly afterwards we find that the trade was to a great extent transferred to Aden.

The Dutch were the first European people to grow the plant at the end of the 17th century at Batavia from Arabian seeds. In 1690 one of these was sent to Witsen at Amsterdam, and the plant soon became known in European gardens. The Dutch also imported the plant into the New World, the first coffee being grown at Surinam in 1718, whence in 1725 it was secretly carried to Cayenne by the French. Its introduction into the West Indies appears to be due to a French naval officer, who in 1720 or 1723 brought the plant to Martinique.

At the present time coffee is cultivated in nearly all tropical and subtropical countries. The berries of some other species

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are used, especially those of *C. liberica*, Hiern., from the West Coast of Africa. It is a larger and more robust plant, and flourishes at a lower elevation than *C. arabica;* its berries also are larger. Coffee leaves are preferred by the natives of Sumatra to the berries; with boiling water they afford a transparent, brown infusion, which when made sufficiently strong is by no means unpalatable. For full particulars, see *Hanbury Science Papers, p.* 84.

Coffee is prepared in the East from the freshly-roasted berries crushed in a mortar and boiled in water; as soon as the water boils the decoction is ready for use and is taken without sugar or milk in small cups (finján) about the size of a large egg cup, and a glass of cold sherbet is taken immediately after it. It contains therefore hardly any of the caffeine, and its virtues almost entirely depend upon the aromatic products produced during the process of roasting. Coffee prepared in this manner or by a rapid process of infusion produces mental exhilaration, physical activity, and wakefulness. Jomand says, "One hundred and twenty grams of powdered coffee and 3 litres of an infusion made with 200 grams of different kinds of coffee enabled me to live for five consecutive days without lessening my ordinary occupations, and to use more and more prolonged muscular exercise than I was accustomed to, without any other physical injury than a slight degree of fatigue and a little loss of flesh." It appears to us highly probable that all the effects which are stated to be produced by the use of Kola seeds would also be induced by the consumption of coffee berries. Comparative experiments are certainly worth trying.

It has been proved by experiment that under the influence of coffee the amount of blood circulating in the brain is reduced, but that it is brought to the nerve tissues under increased pressure, hence assimilation of nutritive material should be increased in rapidity if lessened in quantity. Prolonged mental labour produces cerebral congestion and drowsiness, it is this condition apparently which coffee corrects by contracting the blood-vessels and lessening the amount of blood in the brain. Coffee like other stimulants quickens gastric digestion, stimulates the

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secretion of bile, and by augmenting the peristaltic action of the intestine, promotes defecation; but if taken in excess, it paralyzes the digestive function, and causes venous congestion of the liver, constipation and hæmorrhoids. Coffee is often a useful stimulant in asthma, narcotism, delirium tremens, and during convalescence. Experiments upon animals have shown that coffee and caffeine are direct physiological antidotes to morphia. Coffee and caffeine have been used as diuretics in dropsy. Dr. von Schrœder of Strasburg, from experiments which he has made, arrives at the conclusion that caffeine acts powerfully and energetically upon the renal secretion by direct stimulation of the secretory apparatus, but it may also so affect the vaso-motor centres as to diminish the urinary secretion. In order to eliminate the action of the vaso-motor centres upon the secretory apparatus, Schrœder paralysed these centres in animals by means of chloral hydrate. The result was a marked lowering of blood tension. A rabbit of two kilos weight was narcotised with chloral, and canulas introduced into the ureters. Within 70 minutes 50 centigrams of caffeine was injected by three separate operations into the veins. The quantity of urine secreted during this time was about eleven times greater than under normal conditions. Here the caffeine appeared to act directly upon the renal epithelium. To demonstrate this more clearly, Schrœder cut the nerves of one kidney, leaving those of the other intact. All vaso-motor influence over one kidney was thus prevented, while to preserve it intact over the other, the animal was narcotised with morphia before the experiment. When caffeine was now introduced into the blood of the rabbit, there was a much greater urinary secretion from the kidney, the nerves of which had been divided, than from the other.

The diuretic action of caffeine has hitherto been misunderstood owing to the double influence which it exerts, *viz.*, excitation of the nerve centres like strychnia, and stimulation of the secretory elements of the kidney, the latter being often completely neutralised by the former. Schrœder compares this double action of caffeine to that of pilocarpine. Small

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quantities of these alkaloids are sufficient to cause a specific secretion. He considers that the action of caffeine demonstrates the glandular nature of the kidney and shows that it is not a simple filter. (*Nouveaux Remèdes, Mars* 24, 1887.)

To illustrate the toxical effects of coffee, the following examples may suffice: Fifty minutes after taking a drachm of citrate of caffeine a burning sensation in the throat was complained of, and giddiness with vomiting, purging, and abdominal pain. General paresis with tremor ensued, followed by collapse, but the mind remained clear (*Routh, Practitioner,* xxxi., 48). Fort took an infusion of eight ounces of coffee in a quart of water in the course of a day. The pulse rose to 114, sleep was impossible, muscular spasms occurred all over the body, and were very painful in the extremities, chest, and throat. The tongue was dry, there was nausea with frequent liquid stools, and the pulse ranged from 110 to 114, and was intermittent. The next day there was headache and anorexia. (*Bull. de Thérap., civ.* 350.) The experiments of Lüderitz upon cultivations of various bacteria (*Berl. Klin. Wchenschr.,* 1890,) show that tincture of coffee possesses marked antiseptic properties. These properties cannot be due to caffeine, which has little effect as a germicide, the tannin may exert some influence, but it is probably the products formed during roasting which are the most active agents. It is remarkable that a cup of coffee may be exposed to the air in a room for a week or two without the appearance of any micro-organisms in it.

Description.—The seeds are oval, longitudinally grooved upon the flat side, usually almost completely deprived of the parchment-like, finely-wrinkled testa, fragments of which remain in the groove and sometimes upon the back. The horny albumen is of the shape of the seed, according to the variety, of a yellowish, brownish, bluish, or greenish tint, and is folded, or rather rolled up, whereby the groove is produced. The embryo is situated under the convex side near one end, is slightly curved, and occupies about one-fourth the length of the seed. Raw coffee has a very faint odour and a sweetish,

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slightly astringent, and bitterish taste. The commercial varieties vary considerably in flavour, in size, and in the shade of colour. On keeping, coffee loses during the first year about 8 per cent. in weight, principally moisture ; during the second, 5 per cent., and during the third year 2 per cent., the flavour being at the same time greatly improved.

In Mocha coffee the seed is often quite ovoid, only a single grain being contained in each fruit.

Chemical composition.—The sweetish pulp of the pericarp contains several sugars, of which Boussingault (1881) found 2·37 per cent. cane-sugar, 8·73 per cent. invert-sugar, and 2·21 per cent. mannit. According to Payen's analysis (1849), coffee contains 13 per cent. of fat, 15·5 of glucose, dextrin, and an undetermined vegetable acid, 10 of vegetable casein, 5 of chlorogenate of caffeine and potassium, 3 of nitrogenized principle, 0·8 of caffeine, 0·001 of solid volatile oil, 0·002 of liquid aromatic principle soluble in water, 6·7 of ash, and 1 . of moisture, the remainder being cellulose. The fat consists of palmitin and olein. The acids contained in coffee have been the subject of repeated investigations. These render it probable that, besides a little citric acid, the principal one is *caffeo-tannic acid*, which, according to Rochleder, is Payen's *chlorogenic acid*; its precipitate with gelatin is soluble in the tannin solution; tartar emetic does not precipitate it, but it yields with lead salts and baryta solution yellow precipitates. Vlaanderen and Mulder (1858) separated this principle under the name of *caffeic acid*, and regard the other acids of coffee (*caffeanic*, *cærulic*, and *caffeelic*) as products of oxidation; and they believe the various colours of raw coffee to be due to mixtures of these derivatives. They consider chlorogenic as a mixture of their caffëic and cœrulic acids; Rochleder's *viridinic acid* (1848) may be a similar mixture. The *caffeic acid* of Hlasiwetz (1867) is obtained by continued boiling of caffeo-tannin with excess of potassa solution and separation by sulphuric acid. When pure it has the composition $C^9H^8O^4$, is in straw-yellow crystals, forms mostly yellow-coloured salts, and, like the amorphous gum-like caffeo-tannin, yields with fusing potassa protocatechuic

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acid, $C^7H^6O^4$. By dry distillation pyrocatechin is obtained. Zwenger and Siebert (1861) obtained from Java coffee 0·3 per cent. of kinic acid, which is most likely the coffeic acid of Stenhouse, obtained (1854) from coffee-leaves, and which readily yielded kinone when treated with manganic deutoxide and sulphuric acid. (*Stillé and Maisch.*) König and others have obtained the following results from the analysis of coffee from four various sources:—

	König.		Payen.	Smethan. Roasted average of seven varieties.
	Raw.	Roasted.	Raw.	
Substances soluble in water	27·44	27·45	......	
Nitrogen	1·87	2·31	......	2·26
Nitrogenous matter	11·43	12·05	11· to 13	
Caffeine	1·18	1·38	·8	
Caffetannic acid	...	...	3·5 to 5·	
Fat	13·23	15·03	10· to 13·	10·99
Ethereal oil	...	...	·013	
Sugar	3·25	1·32	......	
Sugar and dextrin	...	...	15·5	
Other nitrogenous matter	31·52	38·41	......	
Cellulose	27·72	24 27	34·	29·28
Ash	3·48	3·75	0·7	4·19
Soluble ash	...	...	......	3·37
Moisture	11·19	3·19	12·	2·87

For information regarding the composition of various coffee substitutes, the reader is referred to König's work already quoted and to Battershall's Food Adulteration.

The roasting of coffee, which is best accomplished at a temperature of about 250° C., renders the seeds pulverizable, and at the same time gives them a more agreeable taste and enables them to yield more of their constituents to water. The coffee thus acquires a chestnut-brown colour and loses about 18 per cent. of its weight. The generation of gaseous compounds ruptures the cells, and a peculiar and agreeable aroma is produced, probably through the decomposition of the fat and

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tannin. But Payen's (as well as Rochleder's) investigations failed to point out the principle to which the changes are due. Very probably they depend upon the decomposition of several of the organic compounds and unquestionably upon the production of a pyrogenated volatile oil, to which the grateful aroma is due. Caffeine does not partake of these changes, except that it is slowly volatilized at the temperature stated; hence the roasting of coffee ought to be effected in closed vessels. Bernheimer (1880) found nearly one-half of the products of roasting to consist of palmitic acid, the remainder being acetic acid, carbonic acid, probably acetone, hydroquinone, pyrrol, methylamine, ·18 to ·21 per cent. caffeine, and ·04 or ·05 *coffeol*, $C^8H^{10}O^2$, to which the aroma of coffee is due; it is an oil boiling at 195° C. (383° F.), and is probably a methyl ether of saligenin. (*Stillé and Maisch.*)

The extract from roasted coffee, mean of eight analyses, had the following composition: 100 parts of coffee yielded to water 25·50 per cent. of extractive, containing ·5 per cent. nitrogen, 5·18 per cent. oil, 13·14 per cent. non-nitrogenous matter and 4·06 per cent. ash. (*König.*)

Mocha coffee yields as much as 7·84 per cent. of ash—consisting chiefly of carbonates and phosphates of potassium, sodium, magnesium, and calcium, the earthy salts amounting to one-seventh or one-sixth of the weight.

The percentage of caffeine contained in raw coffee has been variously stated by different chemists to range from 0·23 (Liebig) to 2·00 (Allen.) Paul and Cownley (*Pharm. Journ., Jan. and Feb.* 1887,) have, however, after examining fourteen different samples of raw coffee dried at 100° C., obtained the following very uniform results:—

Kind of Coffee.	Moisture, p. 100.	Caffeine, p. 100
Coorg	8·0	1·20
Guatemala	8·6	1·29
Travancore	10·0	1·29
Liberia (1)	8·0	1·30
„ (2)	8·0	1·39
Rio	9·1	1·20

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Kind of Coffee.	Moisture, p. 100	Caffeine, p. 100.
Santos, Brazil	9·0	1·29
Manilla	6·6	1·20
Ceylon	6·2	1·24
Perak	7·3	1·22
Costa-Rica	7·2	1·24
Jamaica (pale)	8·7	1·21
Do. (2)	9·0	1·28
Mysore	8·0	1·28

The process for the extraction of the caffeine used by Paul and Cownley was the following:—The coffee in fine powder was mixed with moist lime and exhausted by alcohol in a Waitt's percolator. After removal of the alcohol the dry residue was mixed with a small quantity of water, acidulated by sulphuric acid to convert into sulphate the trace of lime present. After filtration the liquid was shaken with chloroform, and on the evaporation of the chloroform the caffeine was obtained in a crystalline state.

Commerce.—The coffee-cultivating region is Southern India; it supplies most of the coffee consumed in India, and before the coffee blight (which is caused by a fungus, *Hemileia vastatrix*, spreading over the leaves and destroying their functions) it exported large quantities to other countries, as the following figures will show:—

Official years.	Quantities in Cwts.	Value in Rupees.
1878-79	341,186	1,54,36,427
1879-80	359,313	1,62,67,465
1880-81	369,357	1,59,96,688
1881-82	346,364	1,44,74,650
1882-83	353,324	1,39,22,040

Mocha coffee is imported into Bombay, where it fetches nearly double the price of Indian coffee.

Diplospora sphærocarpa *Dalz. Hook. in Kew Journ. ii., p.* 257.

The berries of this tree, growing on the Western Ghauts, are known as "wild Coffee," and, when ripening, are eaten largely by birds and jackals, but they have not been known to be used

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as a substitute for coffee either by the natives or European planters. The berries are from ½ to ¾ of an inch in diameter, and are crowned by the calycine areole. The seeds, numbering from 4 to 10, are arranged in a vertically imbricate manner in the sweetish pulp, they are round and flattened in shape, glossy on the surface, light-brown in colour and horny in consistence. The seeds turn dark brown when roasted, throwing off the parchment-like testa, and when powdered possess an aroma resembling that of coffee. The roasted and powdered seeds were submitted to Brig.-Gen. A. Kenney-Herbert, a great authority on Indian cookery, and he reported as follows.—"The percolated liquor had a remarkably pleasant taste, having a marked flavour of coffee. Indeed, the only difference I could detect was this:—The liquor was not so dark in tint as coffee, being more golden brown than dark brown, and the beverage brewed seemed not quite so strong as would have been produced by a similar quantity of coffee powder. There can be no doubt of the distinct coffee-like properties of this powder, and the absence of any twang or conflicting flavour to mar its pleasant taste.

The seeds contain an alkaloid, which can be separated in the same manner as caffeine, an astringent acid, an aromatic body, some fat, one or more sugars, and four per cent. of mineral matter. The dried extract obtained by boiling water is 16 per cent., or something less than that obtained from cultivated coffee berries.

MORINDA CITRIFOLIA, *Linn.*

Fig.—*Rheede Hort. Mal. i., t.* 52; *Wight Ill., t.* 126.

MORINDA TINCTORIA, *Roxb.*

Fig.—*Bedd. Fl. Sylv., t.* 220.

Hab.—Throughout India, wild or cultivated. The leaves and fruit.

Vernacular.—A'l, Atchi (*Hind.*), A'l, Baratondi, A'sa, Nagakuda (*Mar.*), Núna-maram (*Tam.*), Ach, Achhu (*Beng.*), Munja, Pavattari (*Tel.*), Maddi (*Can.*).

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History, Uses, &c.—The roots of these plants, in Sanskrit Achchhuka, have long been in use as a red dye in India, and the leaves and fruit are used medicinally. A paste of the leaves combined with aromatics is given in diarrhœa and dysentery, and is also used as a tonic and febrifuge. The juice is used as an external application to relieve the pain of gout, and to promote the healing of sores. The fruit is considered to be deobstruent and emmenagogue, and when unripe is eaten as a vegetable in curries. Morinda is extensively cultivated in Malwa; it is sown broadcast or in drills, and the ground ploughed and harrowed. In from 15 to 20 days the seed comes up, the field is then weeded, and the ground stirred. This operation is repeated at intervals during the first year, and in the dry months (January to June) the ground is three or four times irrigated. After the first year no further care is required, and in the third year the plant begins to bear flowers and fruit. In the fourth year the plants are dug up in February and March; one beegah yields from 48 to 72 maunds of wet root, which is allowed to dry in the sun, and then separated into coarse, medium, and fine. A few plants are left for seed until six years old, when the fruit is gathered, placed in heaps, covered with straw and allowed to rot; the seed is then washed out. Wheat or other grain is cultivated between the trees. The root is exported to Guzerat and Hindustan. See *As. Research. iv. p* 40, where an account of the method of dyeing with the root will be found. The plant is also cultivated in Southern India.

Description.—*M. citrifolia* is a small tree with oval, oblong, smooth shining leaves, 10 to 12 inches long, and 4 to 5 inches broad, veins pale, and prominent on the under surface; flowers white, with a long infundibuliform corolla; fruit oblong, 3 inches or more in length, and composed of the succulent enlarged calyces, enclosing many cartilaginous 1-seeded pyrenes; it is of a pale yellowish green colour, and is marked with numerous circular scars; when quite ripe it has an extremely offensive odour like that of putrid cheese. The seeds are black and not unlike quince seeds. *M. tinctoria* is a larger tree, having leaves, flowers and fruit very similar to

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M. citrifolia, but the fruit is smaller, and the leaves are pubescent and in one variety quite tomentose. Some botanists consider it to be the wild form of *M. citrifolia*. Morinda root has a reddish-brown nearly smooth bark, which has a nauseous slightly bitter flavour; the woody portion is hard and of an orange-yellow or reddish-yellow colour. The odour of the freshly dug root is acrid and disagreeable.

Chemical composition.—Anderson has obtained from the root-bark of *M. citrifolia* by exhausting it with alcohol a crystalline principle, *Morindin*, $C^{28}H^{30}O^{15}$, to the presence of which the dyeing properties of the plant are due; after repeated crystallizations from dilute alcohol morindin forms slender yellow needles of a satiny lustre, soluble in boiling water, which on cooling deposits it in gelatinous flakes. Alkalies form with morindin orange-red solutions. Heated in a closed vessel morindin melts, boils, and emits orange vapours, which on condensation form long orange-yellow needles of *Morindon* ($C^{15}H^{10}O^{5}$). Rochleder (*Jahresb. f.* 1851, *p.* 548,) considers morindin to be identical with the ruberithric acid which he has extracted from madder, and morindon to be identical with alizarin, but morindin differs from ruberithric acid in being insoluble in ether and in its behaviour with alkalies; like ruberithric acid it is a glucoside. (*Wurtz, Dict. de Chim., t. ii., p.* 454; *Edin. Phil. Trans., xvi., p.* 434.) Two papers on morindin and morindon will be found in the *Transactions of the Chemical Society* for 1887 and 1888 by Prof. T. E. Thorpe.

Commerce.—One sumai (bundle) of 450 seers or 270 lbs. is worth Rs. 15. The main root is 12 annas per maund, the small roots are more valuable and sell at Re. 1 to Re. 1-8 per maund.

PÆDERIA FŒTIDA, *Linn.*

Fig.—*Griff. Ic. Pl. As., t.* 479, *f.* 3; *Gärt. f. Fruct. iii. t.* 195.

Hab.—Central and Eastern Himalaya, Bengal, W. Peninsula. The plant.

Vernacular.—Gandhali (*Hind.*), Gandhabháduli (*Beng.*), Hiranvel (*Mar.*), Gandhana (*Guz.*), Paedebiri (*Pahúriya*).

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History, Uses, &c.—An article of the Hindu Materia Medica in repute as a remedy for rheumatism. The Sanskrit names are Prásárani, Apehi-vata, "expelling flatulence," and Gandha-bhádáliya. It is the *P. fœtida* of Willdenow (*Spec. I.*, 1219), the Somaráji of the *Asiatic Researches* (IV., 261), the *Convolvulus fœtidus* of Rumphius (*Amb. V.* 436, *t.* 160), and the *Apocynum fœtidum* of Burmannus (*Ind.*, p. 71). The plant is found in most parts of India and all through the Malayan Archipelago, extending from the Mauritius northward to China and Japan; in Assam it is called '*Bedoli Sutta,*' and in China '*Jung-gala*'; it has been lately brought to notice as a fibre-yielding plant; Roxburgh says that the Hindus use the root as an emetic. Rumphius describes it as emollient and carminative, and useful in colic, spasms, rheumatism and gout. Corre and Lejanne say that in Cochin-China it is used as an emetic under the name of *Toui dit.* As a specific in rheumatism, used both internally and externally, it is best known in Hindu medicine. Bháva Misra prescribes an electuary (Prasárani leha), which is made by boiling down a strong decoction of the plant with treacle to the consistence of a thick syrup, and then adding ginger, pepper and Plumbago root. In Chakradatta the method of preparing a liniment (Kubja prásárani taila) will be found. (*Dutt's Hindu Materia Medica, p.* 179.) In the Bombay Presidency the plant is found in the Southern Concan.

Description.—Stem ligneous, twining, young parts round, smooth; leaves opposite, long petioled, oblong-cordate, pretty smooth, entire; stipules broad-cordate; panicles axillary and terminal; flowers numerous, of a deep pink colour; bracts ovate; berry dry, compressed, smooth, with five lines on each side, one-celled, two-seeded; seed compressed, smooth, with a membranous ring all round. (*For fig. see Baillon's Nat. Hist., Vol. VII., p.* 274.) All parts of the plant give off a most offensive odour of bisulphide of carbon when bruised.

Chemical composition.—By distillation with water a volatile oil was obtained, which had the highly offensive odour of the

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fresh drug. We also obtained evidence of the presence of at least two alkaloids; one was soluble in ether and was deposited in minute needles which assumed an arborescent form: the second alkaloidal principle was only slightly soluble in amylic alcohol, chloroform or benzene; we failed to obtain it in a crystalline form. No special colour reactions were obtained with either principle. We propose provisionally for these principles the names α and β *Pæderine.*

SPERMACOCE HISPIDA, *Linn.*

Fig.—*Rheede Hort. Mal. ix. t.* 76; *Burm. Thes. Zeylan. t.* 20, *f.* 3. Shaggy Button weed (*Eng.*).

Hab.—Throughout India. The roots.

Vernacular.—Madana-ghettu (*Tel.*), Nutti-churi (*Tam.*), Ghanti-chi-baji, Dhoti, Gondi (*Mar.*), Thardavel (*Mal.*), Madana-buntakadu (*Beng.*).

History, Uses, &c.—In Southern India the Sanskrit name of this plant is said to be Madanaghanta, and there is a Hindu myth that an oyster will open its shell if touched by the plant. The seeds are thought to be aphrodisiac, and the plant is prescribed to cure hæmorrhoids. Kirkpatrick says the seeds are cooling and demulcent, and are given in dysentery in doses of one pagoda. Rheede says of it: "Succus expressus cum butyro decoctus lienteriæ prodest." Ainslie states that it is used as an alterative and purifier of the blood like sarsaparilla, and is prescribed in decoction, the dose of which is four ounces or more daily. In the Concan it is eaten along with other herbs as a vegetable. According to Bélanger it is used as a tonic and stimulant in Martinique.

Description.—A procumbent, scabrous, or hirsute herb; root fibrous, annual or perennial; leaves obovate spathulate, oblong or elliptic, obtuse or acute, coriaceous, ½—1½ by ¼ to ⅜ in.; flowers 4 to 6 in a whorl, blue or white; capsules hispid or pubescent; seeds oblong, granulate, opaque. In some forms of the plant the leaves have cartilaginous edges.

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RUBIA TINCTORIUM, *Linn.*

Hab.—Cashmere, Sind, Afghanistan, Europe. The roots. Madder (*Eng.*), Garance (*Fr.*).

RUBIA CORDIFOLIA, *Linn.*

Fig.—*Wight Ic.*, *t.* 187; *Dcne in Jacq. Voy. Bot.* 84, *t.* 92. Heart-leaved Madder (*Eng.*), Garance à feuilles cordiformes (*Fr.*).

Hab.—Throughout the hilly districts of India. The roots.

Vernacular.—Manjith, Majith (*Hind.*, *Guz.*), Manjitti, Shevelli (*Tam.*), Manjishta, Tamra-valli (*Tel.*), Manjushta (*Can.*), Manjit (*Beng.*), Manjeshta (*Mar.*).

History, Uses, &c.—Madder is used in Hindu medicine as a colouring agent: medicated oils are boiled with madder to give them colour. It is also a useful external astringent, and is applied to inflamed parts, ulcers, fractures, &c. Chakradatta recommends madder rubbed with honey as an application to the brown spots of *pityriasis versicolor.* The Sanskrit name is Manjishtha. Under the names of Fuvvah and Rúnás, Arabic and Persian writers treat of madder, probably the produce of *R. tinctorium.* *

They do not, however, make any distinction between the species, but simply mention a wild and a cultivated variety. The Mahometans consider the drug to be deobstruent, and prescribe it in paralytic affections, jaundice, obstructions in the urinary passages and amenorrhœa.† They mention the fruit as useful in hepatic obstruction, and a paste made from the roots with honey, as a good application to freckles and other discolorations of the skin. The whole plant is reputed to be alexipharmic; it is also hung up in houses to

* The author of the Makhzan gives Rubia as the European, Dúzarlús as the Greek, and Albisam as the Latin name of madder. *Cf.* Pliny 19, 17; 24, 56, who calls it Rubia and Erythrodanus.

† *Cf.* Theophr. H. P. ix., 14.

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avert the evil eye, and tied to the necks of animals with the same object.*

Ainslie observes that the hakíms are in the habit of prescribing an infusion of madder root as a grateful and deobstruent drink in cases of scanty lochial discharge after lying-in. (*Materia Indica II., p.* 182.) In another notice of the article (*Op. cit. I., p.* 202), he remarks that it would appear to be chiefly produced in Cachar, and the root is in great demand in the adjacent countries, for dyeing their coarse cloths and stuffs red; the Nepalese are in the habit of bartering it for rock salt and borax. Kinnier and Tavernier notice the abundance of madder in Persia and Makran. Dr. G. Playfair, in a note appended to his translation of the *Talif-i-sharífi* (*p.* 150) states that if taken to the extent of about 3 drachms several times daily, it powerfully affects the nervous system, inducing temporary delirium, &c., with evident determination to the uterine system. *R. cordifolia* is common throughout the hilly districts of India, but the Bombay market draws its supplies chiefly from Khelat through Sind, where *R. tinctorium* is cultivated.

Description.—Madder root consists of a short stock, from which numerous cylindrical roots about the size of a quill diverge; these are covered by a thin brownish suber which peels off in flakes, disclosing a red-brown bark marked by longitudinal furrows. The taste is sweetish at first, afterwards acrid and bitter.

Chemical composition.—According to Bucholz, the constituents of madder are as follows:—Resinous red colouring matter 1·2, extractive ditto 39·0, reddish brown substance soluble in alcohol 1·9, pungent extractive 0·6, gummy matter 9·0, woody fibre 22·5, matter soluble in potash 4·6, salts of lime with colouring matter 1·8, water 12·0, loss 7·4. The colouring principles of *R. tinctorium* are *purpurin* and *alizarin*, while *R. cordifolia* yields purpurin and a yellow colouring

* Compare with Dioscorides iii., 151. περὶ ερυθροδάνου, and Pliny 19, 17; 24, 56.

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principle called by Stenhouse *munjistin*: it is to this fact that the inferiority of the latter plant as a dye-stuff is due. According to Higgins, the roots of *R. cordifolia* yield from 50 to 55 per cent. of *garancin*, which has only half the dyeing power of garancin made from *R. tinctorium*. (*Calvert, Dyeing and Calico Printing*.)

The medical action of madder, if any, is probably due to the small quantity of acrid and resinous matter contained in it. For an account of the colouring materials, which are of great importance to the dyer, Ure's *Dictionary of Arts and Manufactures* and Watts' *Dictionary of Chemistry* may be consulted.

Commerce.—Madder from Sind fetches a higher price than that grown in India; it is shipped from Kárachí to the extent of about 1,500 tons annually, and is worth about Rs. 17 per cwt., nearly double the price of Persian madder. The imports of madder (chiefly Persian) into Bombay do not exceed 7,000 cwts. annually.

VALERIANEÆ.

NARDOSTACHYS JATAMANSI, *DC.*

Fig.—*DC. Mem. Valer.* 7, *t.* 1; *Royle Ill.* 242—244, *t.* 54.

Hab.—Alpine Himalaya. The rhizome.

Vernacular.—Chhar, Balchhar, Jatamasi (*Hind.*), Jatamansi (*Beng., Mar.*), Jatamashi (*Tam.*), Jatamamshi (*Tel.*), Jatamanshi (*Can.*), Bhutkés (*Pahâriya*).

History, Uses, &c.—This plant, in Sanskrit Jatamánsi, Mansi, Bhutakesi ("demon's hair"), Pisitá, Tapasvini and Mishi, has from a very remote period been in use among the Hindus as a perfume and medicine. It is mentioned by Susruta in a prescription for epilepsy, and is prescribed by Hindu physicians as a nervine tonic and carminative, and

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aromatic adjunct in the preparation of medicinal oils and ghritas (butters). In the Nighantas it is described as cold and a remedy for leprosy, morbid heat and erysipelas. It is the *Nardin* of Dioscorides, which that writer tells us was also called *Gangitis*, because the Ganges flowed from the foot of the mountains where the plant grew.

Arabic and Persian physicians describe Jatamánsi under the name of Sumbul-i-Hindi, "Indian Spike," to distinguish it from their Sumbul-i-Rumi or Ikliti (*Valeriana celtica*), the root of which is much used in Turkey and Egypt as a perfume. The author of the *Makhzan-el-Adwiya* compares Jatamánsi root to the tail of a sable. He describes it as deobstruent and stimulant, diuretic and emmenagogue, and recommends it in various disorders of the digestive and respiratory organs, and as a nervine tonic in hysteria. He also notices the popular opinion that it promotes the growth and blackness of the hair. The dose is about 45 grains as an expectorant.

Ainslie states that the Vytians in Lower India prepare a fragrant and cooling liniment for the head * from this drug, and also prescribe it internally as a purifier of the blood. Sir W. O'Shaughnessy states as the result of his experience with jatamánsi, that it is a perfect representative for valerian. (*Bengal Disp.*, p. 404.)

When taken habitually in moderate doses, valerian improves the appetite and digestion without confining the bowels. Two drachms at a single dose may occasion a sense of heat and weight in the abdomen, eructations, and even vomiting, colic, and diarrhœa; also some excitement of the pulse, general warmth, and either perspiration or diuresis. In somewhat smaller doses its operation is chiefly restricted to the nervous

* The hair-wash in common use among Indian women, and called Angalepan, Angodvartan, Sughandi-puri or Utnen, is composed of Gávala (seed of *Prunus Mahalib*), Kápûrkachri (*Kæmpferia Galanga*), Vála (*Andropogon muricatus*), Pách (*Pogostemon Patchouli*), Jatamansi (*Nardostachys Jatamansi*), Upalét (*Saussurea Lappa*), Nágarmoth (*Cyperus pertenuis*), Dauna (*Artemisia Sieversiana*), and Murwa (*Origanum*, several species). Other articles are sometimes added.

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system; it renders the mind tranquil, disposes to good humour and activity, produces sometimes a lively formication in the hands and feet, and a sensation about the head and spine which has been compared to the *aura epileptica*. Sometimes, on the contrary, there is a sense of embarrassment in the head, with heaviness and pain. In states of morbid nervous excitement without fever, when through exhaustion the pulse has become small and frequent, valerian lessens its frequency and increases its force and volume.

Given to rabbits in doses of from 1 to 3 drachms, valerianic acid renders the heart's action more rapid, but feebler; the respiration is hurried at first and then slower; and death usually takes place in three or four hours, preceded by prostration and convulsions. If death occurs speedily, the gastric mucous membrane is pale, but if delayed it may be congested; the kidneys are apt to be congested and the urine bloody. Oil of valerian appears to lessen the excitability of the spinal cord, and even to paralyze it, since two Cgm ($\frac{1}{3}$ gr.), injected under the skin of frog, have been found capable of preventing tetanic spasms after a like injection of 5 Mgm. ($\frac{1}{12}$ gr.) of strychnine. Given alone to these animals hypodermically, it impair mobility and sensibility. Valerianic acid, applied to the human skin, produces a white spot, followed by irritation and redness, and upon the tongue it may cause the epithelium to exfoliate.

As a medicine valerian is not a cure for *hysteria*, but it is a most valuable palliative when employed to avert or mitigate hysterical paroxysms provoked by some accidental cause. Especially is this the case in females of weak constitution and excitable temperament, and who are exhausted by care and anxiety. It is still more efficient in preventing the development of those hysteroidal attacks which weak and morbidly sensitive girls and women are liable to, and which consist in an excessive susceptibility to impressions, and in the power of converting into real sensations the suggestions of a disordered fancy, whereby countless subjective perceptions and various disordered actions

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of the lungs, heart, stomach, &c., arise. In mild cases of *mental derangement,* especially when caused by nervous shock or strain; in nervous *atony* simulating paralysis; in cases also of irregular distribution of the blood, accompanied, it may be, with indications of cerebral congestion, or, on the other hand, of cerebral anæmia, of which the chief symptoms are *vertigo,* a sense of rush of blood to the head, or fainting, confusion of sight and hearing, &c., which more than at any other time are apt to occur about the menopause,—valerian is the most promptly efficient of all the palliatives that have been used. In all these cases valerian exhibits the same potency as asafœtida, musk, and castor, and more decidedly. Oil of valerian dissolved in ether may be administered by inhalation in such attacks. Valerian is one of the best remedies for *nervous headache,* especially when it is associated with ammonia, as in the ammoniated tincture of valerian or the popular valerianate of ammonium. These preparations may be used advantageously, along with a carminative tincture, in cases of *flatulence* accompanied with palpitation of the heart. The same medicines are equally efficient in relieving *infantile colic.*

Valerian is one of the innumerable articles that from time to time have been vaunted as remedies for *epilepsy,* and, allowing for the common error of confounding epilepsy with epileptiform reflex convulsions, and even with hysteria, there can be no doubt that it has sometimes cured the disease in females and young children, and especially when it originated in fright or some analogous impression. Even in these cases it must be administered in large doses and be long continued, while other and especially hygienic measures are employed to give permanent strength to the nervous system.

Valerian is useful in the treatment of the milder forms of *delirium tremens,* especially when they follow surgical operations or injuries, and in the ataxic phenomena which belong to the *typhoid state* of fevers and inflammations. It has had some reputation as a *vermifuge* for children when associated

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with purgatives, such as jalap, and by enema as a remedy for ascarides of the rectum. It has also been used successfully for the relief of *dysmenorrhœa* and in *polyuria* or *diabetes insipidus*. Bouchard, however, claims that when the urine contains an excess of urea (azoturia) or of sugar (glycosuria), valerian diminishes the amount of solids discharged and thus acts as a conservator of tissue and of force. (*Stillé and Maisch.*)

Description.—The drug consists of a short portion of rhizome about as thick as the little finger, of a dark grey colour, surmounted by a bundle of fine reddish-brown fibres, the whole forming an object not unlike the tail of a sable or martin. The fibres are produced by an accumulation of the skeletons of the leaves, and are matted together, forming a kind of network; amongst them the remains of flower stalks may be found. The odour of the drug is heavy and peculiar, like a mixture of Valerian and Patchouli, the taste bitter and aromatic. When the central portion is removed and cut across, it is seen to consist of a thin cortical portion connected with the central woody column by four medullary bands, between which are situated large canals which contain the fibro-vascular bundles. The central woody column is of a red-brown colour, angular and jointed, having a certain amount of resemblance to the vertebræ in the tail of an animal.

Chemical composition.—Kemp (1884) obtained three fluid ounces of the oil from 56 lbs. of jatamánsi, and found it to have a molecular rotation of —19·5 in 100 mm., the specific gravity at 82° F. was 0·9748. One hundred pounds of the root submitted to distillation with water by Messrs. Kemp and Co. (1890), yielded fifteen ounces of a pale yellow oil of valerian-like odour, and a faintly acid distillate. A fine violet or bluish colour is produced, as with oil of valerian, by mixing a drop or two of the oil with about 20 drops of carbon bisulphide and a drop of strong nitric acid. With sulphuric acid the oil gives a reddish brown coloration. On boiling the oil acquires a darker hue and a greenish fluorescence. (*J. G. Prebble.*)

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The most important constituent of valerian root is its volatile oil. Free valerianic acid does not exist in the fresh root, but is generated from the volatile oil on exposure. The latest investigation of the oil is by Bruylants (1878), who ascertained some new facts. The hydrocarbon, $C^{10}H^{16}$, was named *borneene* by Gerhardt (1841) and *valerene* by Pierlot (1859). The *valerol* of the latter differed from Gerhardt's valerol, $C^{6}H^{10}O$, which he believed to become oxidized in contact with air to *valerianic acid*, carbonic acid being given off at the same time. Bruylants explains the generation of valerianic acid in old oil of valerian from the decomposition of $C^{10}H^{17}C^{5}H^{9}O^{2}$, which is the valerianic ether of borneol; besides this one, it contains the corresponding ethers of formic and acetic acids, the alcohol *borneol*, $C^{10}H^{18}O$, and its ether, $C^{10}H^{17}O^{2}$. Gerhardt assumed the production of borneol from the hydration of borneene. For a comparison of the chemical constitution of the root of an Indian officinal valerian with that of the European drug, the reader is referred to the next article.

VALERIANA WALLICHII, *DC.*

Fig.—*Asiat. Research. ii., p.* 405.

Hab.—Temperate Himalaya. The rootstock.

Vernacular.—Tagar (*Hind., Beng., Mar.*), Tagar-ganthoda (*Guz.*), Naudibattal (*Can.*), Mushk-i wáli, Bala (*Punjab*), Pámpe (*Bhutan*).

History, Uses, &c.—A fragrant drug called Tagara is frequently mentioned by Sanskrit writers, other names for it are Nandyávarta, Nandini, Varhini, Nahusháкhya, and Pindi-tagara. It is described in the Nighantas as sweet, emollient, pungent, hot and light; a remedy for suppresion of urine, poisons, epilepsy, swoons and headaches. Besides it medicinal uses it is an ingredient in perfumed powders, in the same manner as jatamansi. The drug appears to have attracted the

attention of the Mahometans physicians of India, as we find it described by them as an Indian kind of Asárun (Asarabacca). The author of the *Makhzan-el-Adwiya* describes several kinds of Asárun, and says that the kind known as Tagar in India is with rice spirit given to people attacked by small-pox to lessen the eruption of pustules. Stewart notices the export of this drug to the plains of India for medicinal use. Sir William Jones (*As. Research.* II., 405,) obtained the plant and supposed it to be the source of the jatamansi root of commerce.

It appears to be the Sumbul-jibali of the Arabs and the Kishai-wála of the Persians. Recent experience has shown that this drug like jatamansi is an excellent substitute for the root of our Pharmacopœias.

Description.—The rhizomes are crooked, about two inches long and from ¼ to ½ an inch in diameter, of a dull brown colour, marked with transverse ridges, and thickly studded with circular prominent tubercules, to a few of which thick rootlets still remain attached. The crown is marked by a number of bracts; the lower end is blunt. The rhizome is very hard and tough, and the fractured surface greenish brown. The odour is like Valerian, but much more powerful.

Microscopic structure —Examined under the microscope the outer bark is seen to be composed of ten or twelve layers of compressed cells; within this is a starchy parenchyma, and next to it a cambium layer; within the cambium layer is a broken ring of vascular bundles, and lastly, a starchy parenchyma, thickly studded with conglomerate masses of large cells, having greenish-yellow contents of a resinous appearance.

Chemical composition. – An analysis of the rootstock supplied by one of us* has been made by J. Lindenberg, and the results compared with a fresh analysis of the roots of *Valeriana officinalis* made by the same chemist. (*Pharm. Zeitschr. für Russland,* 1886.)

* Erroneously supposed at the time to be the root of *V. Hardwickii.*

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The following table shows the results—

	V. Wallich.	V. officin.
Moisture	10·46	11·57
Ash	4·04	4·31
Fat and resin, soluble in petroleum-benzine	0·56	0·36
Volatile oil and valeric acid, sol. in benzine	1·005	0·90
Volatile acid, soluble in ether	0·335	0·31
Resin and wax, soluble in ether	0·56	0·85
Resin soluble in alcohol	1·05	0·975
Tannin	3·13	1·64
Citric, tartaric and other acids	0·335	0·565
Glucose	6·03	5·32
Other substances sol. in water, insol. in alcohol	14·96	14·39
Mucilage and albumin, sol. in water	4·16	2·97
Albuminoids extracted by soda	9·72	7·83
Metarabic acid, phlobaphene and albuminoids	19·10	16·70
Starch	14·05	12·87
Cellulose	10·36	11·65
Lignin and other compounds	10·015	16·80

Commerce.—Tagar is chiefly used as a perfume in India, much as valerian was formerly in Europe. Value, Rs. 7 per Surat maund of 37½ lbs.

Valeriana Brunoniana, a variety of *V. Leschenaultii, DC.*, growing on the Nilgiris, affords a root which develops a strong odour of valeric acid when dry, and yields to distillation with water a considerable amount of volatile oil. Dr. G. Bidie has recommended it as a good substitute for European valerian.

The Indian form of **Valeriana officinalis** (*V. dubia*, Bunge), *Ledeb. Ic. Fl. Ross*, *t.* 350, occurs in North Cashmere, but is not known to be used medicinally by the natives.

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Royle (*Antiquity of Hindu Med.*, p. 82,) mentions the use of **V. Hardwickii,** *Wall.*, for medicinal purposes in Nepal. Wallich (*Pl. As. Rar.*, *p.* 40), speaking of the same plant, says: "Nomen omnium specierum in Napalia, *Chamaha.*"

COMPOSITÆ.

VERNONIA ANTHELMINTICA, *Willd.*

Fig.—*Burm. Thes.* 210, *t.* 95; *Rheede Hort. Mal. ii.*, *t.* 24.

Hab.—Throughout India. The fruit.

Vernacular.—Káli-jiri, Somráj, Bakchi (*Hind.*), Somráj (*Beng.*), Kadvo-jiri (*Guz.*), Káttu-shiragam (*Tam.*), Káralyé (*Mar.*), Adavi-jilakara (*Tel.*), Kadu-jirage (*Can.*).

History, Uses, &c.—The Sanskrit names of this common Indian plant are Vákuchi, Somaraji or Somarajin and Avalguja. It has long been highly esteemed as one of the principal remedies for leucoderma and psoriasis, and is also used as an anthelmintic in combination with other remedies. For administration in skin diseases Chakradatta directs the drug to be powdered along with an equal quantity of black sesamum, and a drachm of the powder to be taken in the morning with tepid water, after perspiration has been induced by exercise or exposure to the sun. The diet should consist of milk and rice. In leucoderma, a decoction of emblic myrobalans and catechu is given in addition to the powdered Vákuchi. Externally the drug is applied in skin diseases in a variety of forms, such as paste, oil, &c. Vákuchi is described in the Nighantas as sweet, pungent, digestive, bitter, alterative, astringent, cold, cardiacal, dry, antiphlegmatic; a remedy for cough, fever, and intestinal worms. The author of the *Makhzan-el-Adwiya* describes Káli-jiri, and states that it is given internally to remove phlegm and worms from the intestines, and that a poultice or plaster of it is used to disperse cold tumors. He concludes by saying that the drug is not often prescribed internally, as it is

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thought to have injurious effects, but that it is much used as a cattle medicine. Indian Mahometan druggists sell this drug as a substitute for Átrilál (*Anthriscus Cerefolium*). Ainslie says: "The small dark-coloured and extremely bitter seeds of this annual plant are considered as powerfully anthelmintic, and are also an ingredient of a compound powder prescribed in snake-bites." Rheede states that an infusion of them is given on the Malabar Coast for coughs and against flatulency. The dose of the seed in powder, when administered in worm cases, is one pagoda weight twice daily. (*Materia Ind. II., p.* 54). According to the *Pharmacopœia of India*, the ordinary dose of the bruised seed as an anthelmintic, administered in electuary with honey, is about $1\frac{1}{2}$ drachm, given in two equal doses at the interval of a few hours, and followed by an aperient; the worms are generally expelled in a lifeless state. Dr Æ. Ross speaks favourably of an infusion of the powdered seeds (in doses of from 10 to 30 grains) as a good and certain anthelmintic for ascarides. In Travancore the bruised seeds, ground up in a paste with lime juice, are largely employed as a means of destroying pediculi. Dr. Gibson, as the result of personal experience, regards them as a valuable tonic and stomachic in doses of 20 to 25 grains; diuretic properties are also assigned to them. (*Pharmacopœia of India, p.* 126.) In the Concan the following formula is in vogue as an antiperiodic—Vernonia seeds, Chiretta, Picrorhiza root, Dikamálí, Rocksalt and Ginger, p. æq. Powder, and give 6 massas in cold water, in which a red hot tile has been quenched, every morning.

Description.—The achenes are about $\frac{5}{16}$ inch long, of a dark brown colour, covered with whitish scattered hairs, cylindrical, tapering towards the base, marked with about ten paler longitudinal ridges, and crowned with a circle of short brown scales. The taste is nauseous and bitter.

Chemical composition.—The seeds, as sold in the bazars, lost 9·38 per cent. when heated to 100° C. The ash amounted to 7·7 per cent., and was free from manganese. The powdered seeds were digested with 80 per cent. alcohol, most of the alcohol

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distilled off, and the remainder allowed to evaporate by exposure to air. The alcoholic distillate contained no volatile principle. The alcoholic extract contained a large amount of an amber-coloured oil soluble in petroleum ether, as well as resins. By agitation of the alkaline alcoholic extract with ether, a somewhat bitter extract was obtained, which, besides containing resins, afforded evidence of the presence of an alkaloid, which gave reactions with the usual alkaloidal reagents, but which afforded no special colour reactions. We have provisionally called this principle *Vernonine.*

Commerce.—The plant is common in waste places throughout India. The country people collect the fruit and bring it for sale in the cold weather.

Value.—Rs. 3¼ per Surat maund of 37½ lbs.

Vernonia cinerea, *Less.*, *Rheede Hort. Mal. x., t.* 64, a common weed throughout India in the rainy season, is considered to be the Sahadevi of Sanskrit medical writers in Northern, Southern, and Western India. In the Hindi and Marathi vernaculars it bears the Sanskrit name; in Guzerathi it is Sádeori, a modification of the same name; in Bengali Kúkseem; and in Tamil Sira-shengalanir. Under the latter name Ainslie (*Mat. Ind. II.*, 363) notices it as the Gheruttikámma of the Telingis, used in medicine by the Hindus, in decoction, to promote perspiration in febrile affections. In the Nighantas it is described as cold, sweet, strengthening, astringent, correcting all the humors. For the numerous synonyms, and for a description of this very variable plant, we must refer the reader to the *Flora of British India.* It has no very sensible properties, and the medicinal virtues ascribed to it by the Hindus appear to us to be imaginary.

Elephantopus scaber, *Linn.*, *Wight Ic., t.* 1086; *Rheede Hort. Mal. x., t.* 7, common in shady places throughout India, is the Go-jihva, "ox tongue," of Sanskrit writers, and is described in the Nighantas as cold, light, astringent, cardiacal, alterative and febrifuge; expelling bile and phlegm, and curing urethral discharges. Rheede tells us that a

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decoction of the root and leaves, with cumin and butter milk, is given on the Malabar Coast in dysuria, and in diarrhœa and dysentery. Ainslie calls it *Prickly-leaved Elephant's Foot*, and remarks that Sloane and Browne, in speaking of this plant, say, it is accounted a good vulnerary, and grows in the woods of Jamaica very plentifully; the leaves are frequently employed instead of *Carduus benedictus* amongst the inhabitants of the French West India Islands. The plant has a fibrous root; the leaves are chiefly radical and spread flat upon the ground; they are oblong, wrinkled, crenulate and very hairy; the flower stalk is branched, about a foot high, bearing a few small leaves and heads of flowers with pale purple florets. The plant is mucilaginous and astringent. The vernacular names are Gobhi (*Hind.*), Gojialata (*Beng.*), Gojibha (*Mar.*), Ana-shovadi (*Tam.*), Hakkariké (*Can.*).

Lamprachænium microcephalum, *Benth.*, is a plant of Western India called Aja-dandi and Brahma-dandi in Sanskrit, and Brahmadandi in Marathi and Canarese. It has flowers which smell like chamomile, and a branched, scabrous pubescent stem; leaves petioled, elliptic-acuminate, gradually attenuated into the petiole, pubescent above, hoary and tomentose beneath; heads of flowers small, solitary at the apex of the branches; scales of the involucre squariose, hoary and tomentose beneath, exterior ones lanceolate acuminate, bristle-pointed, ciliated; seeds smooth, shining, without ribs. The plant is used medicinally as an aromatic bitter, but is of little importance as a medicine.

Ageratum conyzoides, *Linn.*, has a strong, aromatic, and rather disagreeable smell; it has a reputation among the Hindus as an external application in agues, and is also worn as a charm against ague when dug up on Sunday with the proper ceremonies. The juice is said to be a good remedy for prolapsus ani. It is freely applied and the gut replaced. Corre and Lejanne state that the plant is used as a sudorific in Réunion under the name of *Herbe à bouc*. *A. conyzoides* is sometimes confounded by the natives with *Vernonia cinerea*,

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and supposed to be a kind of Sahadevi: it is the *Ageratum cordifolium* of Roxburgh, and is called Uchunti in Bengal and Osári in Western India. The plant is a common annual weed throughout India, appearing after the rains and flowering through the cold season; it is from 1 to 2 ft. in height, hispidly hairy, leaves petioled, ovate crenate, heads small, in dense terminal corymbs, bracts striate, acute, ray-florets many, pale blue or white, achenes black, pappus scales 5-awned, often serrate below. (*Fl. Br. Ind., iii.*, 243.)

EUPATORIUM AYAPANA, *Vent.*

Fig.—*Vent. Hort. Malm. t.* 3.

Hab.—America. Cultivated in India. The herb.

Vernacular.—Ayapána (*Hind., Mar., Beng.*), Ayapáni (*Tam., Tel.*), Allápa (*Guz.*).

History, Uses, &c.—Ventenat found this plant growing on the banks of the river of the Amazons; it is also a native of Cayenne; another species, *perfoliatum*, is considered as a febrifuge in America. The Ayapana has been cultivated in India for a considerable time. Ainslie says of it:—"This small shrub, which was originally brought to India from the Isle of France, is as yet but little known to the native practitioners, though, from its pleasant, sub-aromatic but peculiar smell, they believe it to possess medicinal qualities. At the Mauritius it is in great repute, and there considered as alterative and antiscorbutic; as an internal remedy it has certainly hitherto much disappointed the expectations of European physicians. An infusion of the leaves has an agreeable and somewhat spicy taste, and is a good diet drink; when fresh and bruised, they are one of the best applications I know for cleaning the face of a foul ulcer." (*Mat. Ind. II., p.* 35.) Mr. Dyer informed Ainslie that the plant was cultivated in the Island of Bourbon for the purpose of being dried and sent to France, where it was used for making a kind of tea used as a substitute for the tea

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of China. According to Guibourt it is now almost forgotten. (*Hist. Nat* 6me *Ed.* III., 68.) In the *Pharmacopœia of India*, there is the following notice of Ayapana:—"A South American plant, naturalized in various parts of India, Java, Ceylon, &c., and generally known by its Brazilian name, Aya-pana. The whole plant is aromatic, with a slightly bitter sub-astringent taste. The exaggerated ideas of its virtues formerly entertained are now exploded; but there is reason to believe that it is a good stimulant, tonic, and diaphoretic. According to the statements of Bouton (*Med. Plants of Mauritius*, p. 96), it appears to hold a high place amongst the medicinal plants of the Mauritius, being there in daily use in the form of infusion, in dyspepsia and other affections of the bowels and lungs. In the cholera epidemics in that island in 1854-56, it was extensively used for restoring the warmth of the surface, the languid circulation, &c. As an antidote to snake-bites it has been used, both internally and externally, with alleged success. (*Madras Quart. Med. Jour.*, *IV.*, 7.) It is not uncommon in gardens, and though not generally known, is held in considerable esteem by those who are acquainted with it. Ayapana may be compared with chamomile in its effects; it is stimulant and tonic in small doses, and laxative when taken in quantity; the hot infusion is emetic and diaphoretic, and may be given with advantage in the cold stage of ague and in the state of depression which precedes acute inflammatory affections. The infusion may be made with 1 oz. of the herb to a pint of water, and be given in 2 oz. doses every three hours.

Description.—A small shrubby plant, 5 to 6 feet high; branches straight, reddish, with a few simple scattered hairs; young shoots have a somewhat mealy appearance, due to the presence of small particles of a white balsamic exudation; leaves opposite, in pairs, their bases uniting round the stem, about 4 inches long and ¾ inch broad, fleshy, smooth, lanceolate, attenuated at the base; midrib thick and reddish; flowers like those of the groundsel, purple. The odour of the plant is aromatic, somewhat like ivy, but more agreeable; taste bitter and aromatic, peculiar.

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Chemical composition.—On distillation of the fresh plant with water, a colourless oil was obtained, lighter than water, and possessing in a marked degree the odour of the plant. We also obtained a neutral principle, soluble in ether and alcohol, and crystallizing in long needles. It easily sublimed at a temperature of 159°—160° and condensed in beautiful brilliant scales and rhombic prisms. In water it was practically insoluble; it gave no reaction when dissolved in alcohol with ferric salts. In concentrated sulphuric acid it dissolved at once, with only a very faint yellow coloration. In concentrated nitric acid it dissolved immediately with production of a light yellow coloration: among the products of its oxidation by nitric acid, picric and oxalic acid were detected. With Fröhde's reagent a similar tint to that produced by sulphuric acid was yielded. We propose for this principle the name *Ayapanin.*

Eupatorium cannabinum, *Linn., Eng. Bot. V.* 6, *t.* 428, is a native of the temperate Himalaya and Europe; it is the *Herba sanctæ Kunigundis* of Tragus (*Hist.* 491, f.,) the *Hemp Agrimony* of the English, *Water-hanf* of the Germans, and *Origan aquatique* of the French. Though very common in the Himalayas, it does not appear to be used medicinally by the Hindus. The root and leaves have diuretic, and in large doses emetic properties. Boerhaave calls the herb *Rusticorum panacea,* and states that the turf-diggers in Holland use it with great benefit in jaundice, scurvy, foul ulcers, and those swellings of the feet to which they are much exposed. An infusion of 1 oz. of the dried leaves in a pint of water may be used daily; if taken hot it is a good diaphoretic. According to Righini, the leaves and flowers contain a white bitter alkaloid soluble in ether, which forms a crystalline sulphate.

In America **E. perfoliatum,** *Linn.,* and other species are used medicinally under the name of Boneset and Herbe à fièvre.

Solidago Virga-aurea, *Linn., Eng. Bot.* 301, is a native of the temperate Himalaya, Europe, and America. It is the *Golden Rod* of the English, *Verge d'or* of the French,

and *Goldruthe* of the Germans. The generic name is a derivative of *solidare,* to unite, because of the vulnerary qualities of the plant, which were first brought to notice by Arnoldus de Villa Nova, who also highly extolled it as a remedy for stone in the bladder. Gerarde had a high opinion of it as an application to bleeding wounds and ulcers, and says: "I have known the dry herbe, which came from beyond the sea, sold in Bucklersbury for halfe a crowne an ounce. But since it was found in Hampstead wood, even as it were at our townes end, no man will give halfe a crowne for an hundredweight of it; which plainely setteth forth our inconstancie and sudden mutabilitie, esteeming no longer of anything how pretious soeuer it be, than whilest it is strange and rare." He further says, that "*Saracens Consound* is not inferiour to any of the wound herbes whatsoeuer, being inwardly ministred or outwardly applied in ointments or oyles."

The flowering herb has an aromatic odour and a bitterish and astringent taste; it contains a volatile oil.

In America **S. odora,** *Ait.*, is much used as a domestic remedy to produce diaphoresis, to allay colic, promote menstruation, and to cover the taste of nauseous medicines. An infusion may be prescribed, or a few drops of the essential oil.

Grangea maderaspatana, *Poir. Wight. Ic., t.*, 1097, is a common field weed throughout India, growing flat on the ground in the cold weather after the monsoon crops have been harvested. It has sinuately pinnatifid leaves, and solitary, subglobose, leaf-opposed heads of yellow flowers. The odour resembles that of worm-wood. Ainslie (*Mat. Ind. i.*, 481,) calls it *Madras Wormwood*, and says that the Tamil doctors consider it to be a valuable stomachic medicine, and also suppose it to have deobstruent and antispasmodic properties; they prescribe it in infusion and electuary in cases of obstructed menses and hysteria, and sometimes use it in preparing antiseptic and anodyne fomentations. When given internally, Grangea is usually combined with ginger, pepper, and sugar; as an antiseptic application to ulcers, the powdered leaves are used.

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The vernacular names applied to this plant are properly those of Artemisia.

ERIGERON CANADENSIS, *Linn.*

Fig.—*Reich. Ic. Fl. Germ. xvi, t.* 917 ; *Bentl. and Trim. t.* 149. Canada Fleabane (*Eng.*), Vergerette de Canada (*Fr.*).

Hab.—Western Himalaya, Punjab, Rohilkund, Europe, North America.

Vernacular.—?

History, Uses, &c.—This genus derives its name from the Greek ηριγέρων (ἐαρι γέρων, 'aged' or 'hoary in spring'), a term used by Theophrastus for a plant which he describes (H. P. viii.) as κιχοριώδης or like Succory. Dioscorides (iv. 92) describes the same plant as having leaves like ἐυζωμον (*Eruca sativa*) but smaller, yellow flowers, and a white pappus. Pliny (25, 106) calls it Senecio. It is uncertain what this plant was, but it is generally supposed to have been a species of Senecio.

E. canadensis is common in all warm countries, but is supposed to be of American origin, and to have spread over the remainder of the globe since its importation from that continent. Parkinson, in 1640, seems to be the first author who mentions the plant, but he describes it as an American species only. It first became known to French botanists in 1653, and a few years afterwards it had become a weed about Paris; it is supposed to have been imported accidentally from Canada along with bales of skins. Shortly after this, it made its appearance in England, and is now common about London. How and by what means it reached Northern India is not known; it may possibly be a native of that region, especially as it has not made its appearance near the great commercial ports of India as we might expect from the history of its introduction into Europe.

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Several species of Erigeron are used officially as diuretics in the United States of America, and the oil of *E. canadensis* is official in the U. S. Pharmacopœia.

E. canadensis is a stimulant which owes its virtues to a volatile oil. It is popularly supposed in America to have a special action on the uterus, whence its name "Squaw-weed." Stillé states that "almost all of the testimony which has been published respecting the remedial virtues of fleabane, agree in attributing to the Canadian species, astringent and hæmostatic virtues." It has been found a useful remedy in the treatment of diarrhœa, dysentery, &c. The oil was first brought to notice by the eclectic physicians, recent trials seem to indicate that it is a remedy of special value in uterine hæmorrhage. The oil has been observed by R. Barthelow (*Physic. and Surg., April,* 1887,) to check the waste of albumen, to lessen the irritability of the bladder in cystitis, and to afford considerable relief in bronchial catarrh and similar affections. The dose given was five drops, three or four times a day.

The medicinal properties of *E. canadensis* do not appear to be known to the natives of India, nor have we heard of any vernacular name for it.

Description.—Stem 6 inches to 3 feet, simple, erect, slender, striate, with scattered hairs; branches numerous, ascending; radical leaves spathulate, or narrowly obovate, dentate, stem leaves linear-lanceolate, acute; heads very numerous, about $\frac{1}{4}$ inch long, involucre bracts acuminate, ligules pale rosy or purplish, scarcely exceeding the pappus, disk flowers yellow; achenes $\frac{1}{16}$ of an inch, narrow, flat, nearly glabrous, pappus $\frac{1}{8}$ of an inch. The plant has a mint-like odour, and an astringent somewhat bitter taste.

Chemical composition.—The plant contains a volatile oil which is a limpid, pale yellow liquid of a peculiar aroma and persistent odour, somewhat terebinthinate and of an aromatic, not very pungent taste. According to A. M. Todd (*Amer. Journ. Pharm., June,* 1887,) the specific gravity of the natural oil is not above ·865, nor below ·855; it should not boil vigorously

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below 342° F., nor above 347° F. until five per cent. has been volatilized; when redistilled it is colourless, and a resinous product of a deep reddish brown colour is left in the retort. The pure oil in the natural state should not polarize nearer the zero point than —26, nor further than —60; the rectified oil, freed from resin, may polarize somewhat nearer the zero point than the limit given, and the first fractions should be dextrogyre. The oil dissolves iodine without explosion, is gradually coloured reddish by potash, and is slowly acted upon in the cold by fuming nitric acid. It dissolves freely in ether and absolute alcohol, but is only moderately soluble in 80 per cent. spirit. The oil consists mainly of a terpene, $C^{10}H^{16}$, specific gravity ·8464, boiling at 176° C., and yielding a crystalline dihydrochloride which fuses at 47°.—48° C. (*Beilstein and Wiegand, Ber. der Deutch. Chem. Ges. xv.*, 2854.)

Erigeron asteroides, *Roxb.*, Maredi (*Hind.*, *Guz.*), Sonsali (*Mar.*), is used in India as a stimulating diuretic in febrile affections. It is an annual, flowering during the cold season, and a native of dry cultivated lands.

Stem erect, from 6 to 12 inches high, ramous near the ground, round, hairy; branches ascending, longer than the stem; leaves alternate, the inferior ones short petioled, oval or obovate, grossly toothed, the superior ones sessile, oblong, sub-lyrate, all are covered with soft down and are somewhat glutinous; flowers few, terminal, peduncled, large, flat; hermaphrodite florets of the disc yellow, the female ones ligulate, those of the border blue, generally entire or only emarginate. (*Roxb.*)

BLUMEA BALSAMIFERA, *DC.*

Fig.—*Rumph. Amb. vi. t.* 24, *f.* 1. Oostindische ofte wilde Salie (*Dutch*).

Hab.—Tropical Himalaya, Burma, Eastern Peninsula. The camphor.

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BLUMEA DENSIFLORA, *DC.*

Fig.—*Seem. Fl. Vit.* 141, *t.* 27.

Hab.—Tropical Himalaya, Malay and Fiji Islands. The camphor.

Vernacular.—Ngai (*Chin.*), Kai-dai-bi (*Coch.-Chin.*), Sombong, Bangachappa (*Malay*), Pung-ma-theing (*Burm.*), Kukronda (*Hind.*), Kuksungh (*Beng.*). The Hindi and Bengali names are also applied to other strong smelling Blumeas.

History, Uses, &c.—The camphoraceous Blumeas are called by Sanskrit writers Kukundara and Kukkura-dru, "dog-bush" because their pungent odour is attractive to those animals; the vernacular names are derived from the Sanskrit. In addition to the two plants placed at the head of this article, *B. aromatica,* DC., and *B. lacera,* DC., are considered by the Hindus to be deobstruent and resolvent, and particularly useful in the disease of the nose called *Ahwah,* said to be peculiar to Bengal, which is accompanied by strong fever, heaviness in the head, pains in the body, especially in the neck, shoulders and loins; the powdered leaves are given internally in two drachm doses mixed with butter, and also used as a snuff. The juice of the leaves is placed in the eye to cure chronic purulent discharges; it is also used as an anthelmintic, and as an astringent in dysentery, chronic discharge from the uterus, &c. A preparation (márana) is made by oxidizing steel filings in the juice of these plants, which is highly esteemed as a remedy for renal dropsy. Dr. Anderson of Bijnor has found the fresh juice of *B. lacera* useful as an anthelmintic, especially for thread worms, and Dr Bolly Chand Sen of Calcutta speaks of it as invaluable in *Tinea tarsi.* Mir Muhammad Husain in the *Makhzan* describes *Kukronda* as a plant two cubits in height, much branched, having long crenated leaves not unlike endive leaves, but larger and softly downy, of a dark green colour, pungent odour, and astringent taste; flowers small, yellow; fruit like the anemony (downy); seeds small, black, pubescent. (*B. densiflora?*)

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The *Conyza odorata* of Rumphius is considered by Roxburgh to be *B. balsamifera*; the *Baccharis salma* of Loureiro is probably the same plant, and also the *Planta Bantamica* of Clusius (iv. 23), which was discovered by Colius in Batavia prior to the year 1619. Clusius states that it is used as a condiment and as a remedy for colic, and in paralysis as a stimulant fomentation or bath; given in decoction with the leaves of *Vitex Negundo*, *Careya arborea* and *Citrus acida* it produces copious perspiration. It is also used as a vermifuge and as an astringent in menorrhagia. Dr. Mason (*Burmah, its People and Natural Productions*, Lond., 1852,) mentions the manufacture of a camphor by the Tavoyers from *B. densiflora*, one of the most abundant weeds throughout the Tenasserim Provinces. Subsequently a Mr O'Riley of Amherst manufactured and purified more than 100 pounds of this camphor which was sent to Calcutta for trial, and pronounced to have the same medicinal properties as ordinary camphor. In 1874, Hanbury (*N. Repert. f. Pharm.* xxiii., 321,) pointed out that this was the Ngai camphor mentioned by Rondot (*Etude Pratique du Commerce d'Exportation de la Chine*, Paris, 1848,) which was worth 250 dollars the picul (133⅓ lbs.) in China. Mr. Hanbury also obtained from Mr. F. H. Ewer of Canton a sample of Ngai camphor, and of the plant from which it was manufactured in China (*B. balsamifera*); he also ascertained that the camphor was used in medicine by the Chinese and largely for the purpose of perfuming inks at the ink factories of Wei-chan and other places.

Description.—*B. balsamifera* is a large shrubby plant with an erect ligneous trunk, and branches covered with ash-coloured bark. Leaves alternate, short-petioled, lanceolate, irregularly serrate, and generally more or less pinnatifid at the base, downy, particularly underneath, where they are sericious and beautifully reticulated with numerous veins, from 6 to 12 inches long; petioles short, often with 1 to 4 small leaflets; corymbs terminal, numerous, bearing many sub-cylindric bright yellow flowers. (*Roxburgh.*) The plant smells strongly of wormwood and camphor.

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B. densiflora very closely resembles *B. balsamifera*, and is united with it by some botanists. *B. lacera* has an erect branching stem, the principle leaves of which are petioled and lyred, the superior ones simply oval and much smaller, all are sharp toothed, downy, and various in size. Umbellets terminal, and from the exterior axils, peduncled. Flowers a dull yellow. The plant has a strong odour of wormwood and camphor.

Chemical composition.—*B. balsamifera* and *densiflora* contain a volatile oil having the odour of wormwood, and a camphor which has been examined by Sydney Plowman, 1874, who found its composition to be Carbon 77·56, Hydrogen 11·6, Oxygen 10·84, whilst Borneo camphor examined at the same time yielded C 77·66, H 11·68, O 10·66 and Laurel camphor C 78·2, H 10·44, O 11·36. Ngai camphor has the same physical properties as Borneo camphor, but the two substances differ in optical properties, an alcoholic solution of the former being *levogyre* in about the same degree that one of the latter is *dextrogyre*. By boiling nitric acid, Borneo camphor is transformed into common (*dextrogyre*) camphor, whereas Ngai camphor affords a similar yet *levogyre* camphor, in all probability identical with the stearopten of *Chrysanthemum Parthenium*, Pers. (*Hanbury Science Papers, p.* 393 ; *Pharmacographia.*)

Commerce.—This camphor has of late years been fraudulently sold as Borneo camphor in India. The value of Ngai camphor in China is about 250 dollars a picul, whereas Borneo camphor costs about 2,000 dollars for the first quality and 1,000 dollars for the second.

Blumea eriantha, *DC.*, a native of Western India, is called Nimurdi in Marathi, and is used by the country people to drive away fleas. It is very common in the Concan, and is remarkable for the clusters of globose, woolly buds crowded together at the crown of the root, and for the strong odour of caraways which it possesses. The habit of the plant is variable, in cultivated ground it is erect, but in pasture land prostrate or decumbent. The flowers are yellow. Medicinally the juice

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of the plant is administered as a carminative, and the herb used along with the leaves of *Vitex Negundo* and *Careya arborea* for fomentations. A warm infusion is given as a sudorific in catarrhal affections, cold it is considered to be diuretic and emmenagogue. Under the names of Bhámburdi (*Mar.*), Kalára and Chánchari-mari, "flea-killer" (*Guz.*) several kinds of Blumea are used indiscriminately by the natives of Western India. The plants generally supplied by the herbalists being *Blumea lacera, Laggera aurita* and *Blumea eriantha.*

In Southern India, under the names of Jangli or Divarimuli (*Dec.*), Nárak-karandai, Káttu-mallángi (*Tam.*), Káru-pogáku, Adavi-mullangi (*Tel.*), *Laggera aurita*, Schultz-Bip (*Blumea aurita*, DC.) is according to Dr. Moodin Sheriff, chiefly used. When young the foliage resembles that of a radish, the flowers are white or pinkish. Some Mahometan physicians use this plant as a substitute for Kamáfitus, the χαμαιπίτυς of the Greeks, which was *Ajuga Chamæpitys*, Schreber, a labiate plant.

Chemical composition.—The entire plant of *B. eriantha* in flower, without roots, was air-dried and reduced to fine powder.

On heating to 100° C., 8·76 per cent. was lost, due to moisture and volatile oil. The ash amounted to 8·31 per cent., it was of a light brown colour, and contained marked traces of manganese and iron.

On distillation with water a colourless oil was obtained, lighter than water, and which possessed in a marked degree the odour of the drug. The oil had a sp. gr. of ·9144 at 80° F., and was strongly levogyre. The plant yielded to petroleum ether 3·02 per cent. of extract, to ether 1·55 per cent., and to alcohol 3·40 per cent.

The various extracts contained chlorophyll, a dark acid resin, a trace of tannin, malic acid, volatile oil, and a wax, and in addition, from the ether extract a crystalline principle was obtained. This principle after repeated crystallization from alcohol was of a light lemon yellow colour, in tufts of needles, or by slow crystallization in very large rhombic prisms. It was without odour, gritty between the teeth, and without any

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decided taste. In water, cold or boiling, it was practically insoluble, it was slightly soluble in cold ether and alcohol, but was not easily soluble even in boiling alcohol. The ethereal solution left the principle, on spontaneous evaporation, as a dull adherent deposit on the sides of the vessel. The crystalline principle had a melting point of 156° C. (uncorrected); it did not contain nitrogen. With reagents it gave the following reactions:—

Concentrated sulphuric acid dissolved it, the solution being of a bright yellow colour; on the addition of water the acid became milky from separation of white flocks. Concentrated nitric acid gave an orange-red coloration; hydrochloric acid produced no change either in the cold or on heating. Fröhde's reagent gave a yellow colour, changing to yellowish-green on heating. Sulphuric acid and potassium bichromate no special reaction. An alcoholic solution gave with ferric chloride a dirty greenish brown coloration; with ferrous salts, a dirty reddish coloration, which disappeared on heating, leaving the solution of a pale yellow tint. The addition of alkalies to an alcoholic solution produced a bright yellow colour; in hot or cold aqueous alkaline solutions the principle was insoluble.

This principle would appear to be allied to the quercitrin group, but does not appear to be identical with any of those hitherto described; we reserve, however, a definite expression of opinion for the present.

PLUCHEA LANCEOLATA, *Oliv.*

Fig.—*Deless. Ic. Sel. iv., t.* 21. Syn. *Berthelotia lanceolata.*

Hab.—Upper Bengal, Oude, Punjab, Sind.

Vernacular.—Ra-sana (*Punj.*), Koura-sana (*Sind.*)

Description.—An annual, with spreading branches, and opposite, petioled, oval or oblong leaves covered with stomata on both sides, edges vertical; florets tubular, with silky pappus. It forms thickets up to four and five feet high. The leaves are

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said to be aperient, and used as a substitute for senna. We have not had an opportunity of examining them.

SPHÆRANTHUS INDICUS, *Linn.*

Fig.—*Wight Ic. t.* 1094; *Rheede Hort. Mal. x. t.* 43.

Hab.—Tropical Himalaya, and southwards to Ceylon. The herb.

Vernacular—Mundi, Gorakh-mundi (*Hind., Mar., Guz.*), Murmuria (*Beng.*), Kottak-karandai (*Tam.*), Boda-tarapu (*Tel.*), Mundikasa (*Can.*).

History, Uses, &c.—This plant, which is very common in rice fields, is called in Sanskrit Munditika or Mundi, Bhikshu, Pari-vráji (mendicant) and Tapo-dhaná (rich in religious penance). It is described in the Nighantas as pungent, bitter, and stomachic; sweet, light and stimulant, a remedy for glandular swellings in the neck, urethral discharges and jaundice. The dose of the powdered herb is about a scruple or a scruple and a half twice daily, but more may be given. Rheede, who speaks of the plant under the name of *Adacamanjen*, tells us that the powder of the root is considered stomachic, and that the bark ground and mixed with whey is a valuable remedy for piles. The plant with cumin is stomachic; with honey it is given for cough; and ground with oil, it is used to cure itch. Burmann calls it *Sphæranthus purpurea.* Forskahl speaks of it under the name of *polycephalos*, and Dr. Horsfield, in his account of Javanese medicinal plants, informs us that the inhabitants of Java consider it as a useful diuretic. (*Ainslie, Mat. Ind. II.*, p. 167.) By some Indian Mahometan physicians this plant has been supposed to be the Kamázariyús* of Arabic writers, but the author of the *Makhzan-el-Adwiya* says that this is a mistake, and describes Mundi in a separate article. He speaks of it as a powerful tonic, deobstruent and

* χαμαίδρυς Teucrium Chamædrys, *Linn.* Petit Chêne, (Fr.) Ground Oak or Germander, considered to be tonic, diuretic and sudorific, one of the ingredients of the celebrated Portland Powder. Conf. Dios. iii. 103.

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alterative, and observes that the odour of the plant may be perceived in the urine and perspiration of those who are taking it. The administration of the drug is recommended in bilious affections, and for the dispersion of various kinds of tumours. The distilled water is mentioned as one of the best preparations; it is directed to be made in the same manner as rose water. Mir Muhammad Husain also states that the Hindus use the bark, and make a kind of confection of the young plant by rubbing it up with clarified butter, flour and sugar; a portion of this taken daily is said to be a good tonic, and to prevent the hair turning white or falling off. Several other somewhat similar preparations of different parts of the plant are mentioned by him, and are described as preservatives of the animal powers. An oil prepared from the root, by steeping it in water, and then boiling in oil of Sesamum until all the water is expelled, taken fasting every morning for 41 days in doses of 2 dirhems, is said to be a powerful aphrodisiac (تقویت باه بعدے بخشد کمر شرح نئوان نمود). Experiments with the distilled water show that it is not diuretic; in the case of a cachectic native suffering from frequent micturition caused by chronic prostatitis it afforded much relief. A European suffering from boils derived decided benefit from taking a wineglassful three times a-day.

Description.—Plant generally about 8 inches high, winged; leaves thick, sessile, decurrent, obovate, bristle-serrate, covered with down, consisting of long white hairs; flower heads solitary, mostly terminal, sub-globular, the size of a small marble, purple when fresh, but lose their colour when dried; roots fibrous. The drug generally consists of the whole plant, but the capitula are sometimes sold separately. The taste is somewhat bitter, the odour of the capitula terebinthinate.

Chemical composition.—150 lbs. of the fresh herb distilled with water in the usual manner yielded a very deep sherry-coloured, viscid essential oil, very soluble in water, and clinging to the side of the vessel, so that only half an ounce could be collected. The oil does not appear to have any

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rotatory power, but it is difficult to examine on account of its opacity.

The most important principle detected in the leaves, stems and flowers of the plant was a bitter alkaloid soluble in ether, affording reactions with the ordinary alkaloidal reagents, but giving no special colour reactions. We have provisionally called this alkaloid *Sphæranthine*.

Commerce.—The dried herb, and also the dried flower heads, are sold in the bazars.

INULA HELENIUM, *Linn.*

Fig.—*Woodville Med. Bot.*, t. 26; *Bentl. and Trim.* 150. Elecampane (*Eng.*), Aunée (*Fr.*).

Hab.—Central Asia, Central and Southern Europe. The root.

History, Uses, &c.—All the Indian Mahometan writers on Materia Medica mention this drug under the names of Rásan, Kust-i-shámi, or Zanjabil-i-shámi, *i.e.* Syrian Costus or Syrian ginger. Rásan is a Persian name for the plant which has been adopted by the Arabs. From the *Burhán-i-Katia* we learn that the plant is also known in Persia as Pil-gush (elephant's ear), and Gharsa, and is useful for eruptions and all kinds of pains, especially those arising from chill, bites of animals, &c. Elecampane is the ἑλένιον of the Greeks, and is described by Hippocrates as a stimulant of the brain, stomach, kidneys and uterus; it is the Inula of the Romans and the Enula campana of mediæval writers, and was formerly much used in pectoral affections, such as cough and asthma, and in acid dyspepsia, rheumatism, &c.; an ointment made with it was used to cure itch. It is still a domestic remedy in France and Germany, and to a less extent in England, and the root holds a place in the Pharmacopœias of Germany, France and the United States of America. The root is preserved as a pectoral candy on the continent of Europe, and is used in France in the preparation of absinthe. Of late years the active

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principle, *helenin*, has been introduced into medical use, and is said to possess remarkable antiseptic properties; it is recommended as a gargle in ozæna and internally in diseases of the respiratory organs for reducing inflammation. It is said to speedily relieve chronic bronchitis, and has also been employed in anthrax and acid dyspepsia. Korab claims for helenin a power of destroying bacilli (*Bull. de Therap.* ciii. 271). The dose of this principle is from ⅙ to ⅓ of a grain.

It is imposible to determine whether Elecampane was known to the ancient Hindus, but the old Persian name Rásan leads us to suspect that it was possibly the original Rásna of the Hindu Materia Medica, although entirely different roots are now in use under that name. It is significant that Gandhamula, *i.e.* "aromatic root," is a synonym for the rásna of the Nighantas, whilst the roots actually in use are not aromatic; the properties also attributed to these roots in the same books are those of Elecampane and not of the inert roots now in use in the plains of India.

Inula racemosa, *Hook. f.*, a native of the Western Himalayas and Cashmere, is used in veterinary medicine in those parts, as a tonic and stomachic; its roots closely resemble in properties those of *I. Helenium.*

Aitchison informs us that **I. Royleana,** *DC.*, a native of the same districts, is largely used to adulterate Costus.

Pulicaria crispa, *Benth.* (*Inula quadrifida*, Ham.), a native of the Punjab and Upper Gangetic plain, is called Phatmer or Phatmel in Hindi (फट, a rent, and मेल, union), and according to Stewart is used as a vulnerary.

Description.—The root of *I. Helenium* is about 6 inches long and 1 or 2 inches thick, divided below into branches 6 to 12 inches long and ½ to 1 inch thick, very fleshy, in commerce always sliced either longitudinally or transversely.

The longitudinal slices have the bark overlapping; the transverse slices are concave, somewhat radially striate; externally irregularly wrinkled and brownish, internally white

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when fresh, greyish after drying, of a peculiar aromatic odour and an aromatic, bitterish, and pungent taste. The root is hygroscopic and flexible in damp weather, but when dry breaks with a short fracture. The bark is $\frac{1}{8}$ inch or more thick, the inner portion radiates near the cambium line; the meditullium has small fibro-vascular bundles and broad medullary rays, and all parts of the root are dotted with shining yellowish-brown resin-cells.

Chemical composition.—Elecampane contains a little *volatile oil*, some acrid *resin*, *a bitter principle* not known as yet in the isolated state, *waxy matter*, *inulin*, etc. On investigating the body formerly known as helenin and elecampane camphor, which crystallizes from the concentrated tincture mixed with water, Kallen (1873) isolated *helenin*, C^6H^8O, which is insipid, almost insoluble in water, crystallizes in needles, fuses at 110° C., and is by nitric acid converted into oxalic acid and a resinous body. On distilling the root with steam, Kallen (1876) obtained *inula camphor* or *alant camphor*, $C^{10}H^{16}O$, and *inulol* or *alantol*, $C^{15}H^{20}O^2$. The first of these forms colourless needles of a faint camphoraceous odour and taste, melts at 66° C., and is sublimable and very slightly soluble in water. Alantol is a yellowish liquid having the odour of peppermint and an aromatic taste, boiling near 200° C., and yielding crystallizable alantic or inulic acid, $C^{15}H^{22}O^3$. *Inulin*, $C^{12}H^{20}O^{10}$, is contained in the subterraneous parts of Compositæ, and is obtained by forcibly expressing the grated juicy roots, when a portion will deposit on standing, and the remainder may be precipitated by alcohol. Kiliani (1881) recommends boiling the roots with water containing sodium carbonate; the liquid is cooled by a freezing mixture, and the precipitate repeatedly dissolved in hot water and reprecipitated by cooling. The autumn roots contain the largest percentage (elecampane 44 per cent.) of inulin, which by the following spring is to a considerable extent changed into mucilage, sugar, and levulin, and in some cases to glucosides. Inulin is a fine white powder, tasteless and inodorous, insoluble in alcohol, slightly soluble in cold water, more so in hot water, and then partly

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altered, but mostly reprecipitated on cooling; on the slow evaporation of its aqueous solution it may be obtained in crystalline spheres, and by hydration it is converted into gum-like and horny modifications. It appears to be the anhydride of levulose, its formula being $C^6H^{10}O^5$ $^6H^2O$, but it does not reduce Fehling's solution. Heated with water in sealed tubes, it yields levulose; with hot baryta-water lactic acid is formed, diluted nitric acid oxidizes it to formic, oxalic, racemic, glycollic, and probably glyoxylic acids. Inulin differs from starch by the absence of concentric layers, does not yield a jelly with water, and it is coloured yellow (not blue) by iodine. (*Stillé and Maisch.*)

XANTHIUM STRUMARIUM, *Linn.*

Fig.—*Eng. Bot.* 36, *t.* 2544; *Matth. Valg.* 2, 545, *f.* Broad-leaved Burweed (*Eng.*), Lampourde (*Fr.*).

Hab.—Hotter parts of India and Ceylon. Europe. The herb.

Vernacular.—Gokhru-kallán (*Punj.*, *Sind.*), Ban-okra (*Beng.*), Marlumatta (*Tam.*), Veritel-nep (*Tel.*), Shankeshvar (*Mar.*), Shankhahuli (*Hind.*), Kadvalamara (*Can.*).

History, Uses, &c.—The ξάνθιον of Dioscorides (IV. 133,) appears to be this plant; he tells us how it should be used to dye the hair, and also notices its use in dispelling tumours. The generic name has been given it on account of its containing a yellow-colouring matter, and the specific name is an allusion to its use in scrofula. It is the *Xanthium seu Lappa minor* of Ray, Bauhin and Matthiolus. In some parts of Germany, where it is called Spitzklette, it has a popular reputation as a remedy for ague, and in Russia it is considered to be a prophylactic in hydrophobia. In the Punjab and Sind it is called *Gokhru kallán*, or 'great Gokhru,' and is given in small-pox on the doctrine of signatures (*Stewart*); its hairs and prickles are employed in medicine in China. (*Smith.*) It appears to be the Hasak of the Eastern Arabian physicians, and the Hamaz-el-amir of the Western, it is the

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Khár-i-khasak of Persia, and Háji Zein informs us that it is called Khâr-i-súhúk at Shiraz, and Harada at Ispahan; the last name is an allusion to its yellow colour, Harad is the old Persian for turmeric. Hasak is described by Mahometan writers on Materia Medica as useful for dispelling tumours and curing ophthalmia, also in renal and urinary complaints as a diuretic, and in colic; it is said to be aphrodisiac. The Hindus consider the whole plant to be diaphoretic and sedative, and very efficacious in long-standing cases of malarious fever; it is generally administered in the form of decoction, and is said to be the Shánkhini or Shankhapushpi of Sanskrit writers. Loureiro states that the seeds are attenuant and resolvent of inflammatory swellings. In America and Australia this plant has been observed to prove fatal to cattle and pigs which have pastured upon it. Modern experiments with the drug seem to indicate that like Jaborandi it is sudorific, sialogogue and slightly diuretic. The dose given has been 10 grains of the dry leaves.

Description.—Stem erect, scabrous, clouded with dark-coloured spots; leaves alternate, petioled, cordate or kidney-shaped, notched, waved, 3-nerved, scabrous, about 4 inches in diameter, petioles round, scabrous, as long as the leaves; flowers terminal and from the superior axils, male aggregate above the female, short peduncled; female, subsessile, solitary; germ superior, oblong, armed with uncinate bristles, 2-celled, each cell containing one ovule enveloped in an interior tunic.

Chemical composition.—Zander (1881) obtained from 100 parts of the fruit 5·2 ash, 38·6 fat, 36·6 albuminoids, 1·3 *xanthostrumarin* and organic acids, besides sugar, resin, &c. Xanthostrumarin seems to be a glucoside, is yellow, amorphous, soluble in water, alcohol, ether, benzol and chloroform, and yields precipitates with group reagents for alkaloids, and with ferric chloride, lead acetate, and salts of other metals, but is not precipitated by tannin or gelatin. Xanthostrumarin is related to datiscin, which is coloured yellow by alkalies, gives a green precipitate with ferric chloride, and a yellow one with

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acetate of lead. M. V. Cheatham (1884) obtained only 14·5 per cent. of fixed oil, and a principle which was precipitated by tannin. (*Amer. Journ. Pharm.*, 1881, 271, *and* 1884, 134.)

SIEGESBECKIA ORIENTALIS, *Linn.*

Fig.—*Wight Ic.*, *t.* 1103; *Schk. Han.* 3, *t.* 256. Herbe-guérit-vite (*Fr.*).

Hab.—Throughout India. Cosmopolitan in warm climates.

Vernacular.—Ho-kien, Kau-kau (*Chin.*), Katampam, Katampu (*Tam.*).

History, Uses, &c.—This plant is named after Dr. George Siegesbeck, a German physician, fomerly director of the gardens at Petersburgh. It appears to have been long known in China as a remedy for ague, rheumatism, and renal colic; but as far as we know, its medicinal properties are not known to the natives of India. The properties of the plant have been studied by Vinson and Louvet, who state that in the island of Réunion it has a considerable local reputation as a sialagogue, vulnerary, tonic, aperient and depurative; it is an ingredient in Périchon's *Sirop depuratif végétal*, which is used as a remedy in venereal and scrofulous affections. The juice of the fresh herb is used as a dressing for wounds, over which, as it dries, it leaves a varnish-like coating. A decoction of the leaves and young shoots is used as a lotion for ulcers and parasitic skin diseases. Other preparations of the plant are a wine and a watery extract. Auffrey of the Mauritius separated a bitter principle from the drug which he named *darutyne*, in honour of Dr. C. Daruty, the author of a work upon the medicinal plants of that Island.* J. Hutchinson (*Brit Med. Journ., June* 25, 1887,) has recommended a tincture of Siegesbeckia as a local application in certain skin diseases; he remarks that most of the medicaments now in use inconvenience the patient on account of their greasy nature, and, if

* Plantes médicinales de l'île Maurice et des pays intertropicaux. Maurice: 1886. Christy, *New Commercial Plants*, No. 9, pp. 49-52.

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not greasy, they do not afford relief to the dryness and tension of the skin. The affected parts are rubbed night and morning with a mixture of equal parts of the tincture and glycerine, which appears to act as a stimulant and parasiticide, the pain is soon relieved, and the eruptions disappear.

Description.—A much branched, erect herb, 1 to 3 feet high, with opposite, broadly triangular or ovate, coarsely toothed, more or less scabrous leaves. Flowers yellow, the ray-florets are strap-shaped and pistil bearing, those of the disk tubular and perfect. The exterior scales of the involucre are twice the length of the inner. The achenes are without pappus, and are half inclosed by the chaffy scales of the receptacle.

Chemical composition.—The bitter principle of this plant was discovered in 1885 by M. L. Auffray and named *Darutyne*, and a specimen of the white crystalline scales was shown in the Indian and Colonial Exhibition, London, 1886. Darutyne is prepared by treating a strong decoction of the fresh leaves with subacetate of lead to precipitate the colouring matter, the lead being removed by diluted sulphuric acid, and the filtered liquid evaporated to an extract, triturated with one-quarter of its weight of lime and dried at 144° F. It is then treated with alcohol, part of the alcohol distilled off, and the residue mixed with five or six times its volume of water, slightly acidulated. The precipitated substance after filtration is treated with alcohol, and mixed with two or three times its volume of water, when the darutyne crystallizes out, the yield being 0·15 per cent. The crystals are soluble in alcohol and ether, but insoluble in cold water, dilute acids, alkalies and chloroform and are neutral to test paper. M. Auffray finds that it does not give the reactions for glucosides, alkaloids, acids, or resin. Concentrated sulphuric acid dissolves the crystals with a brownish colour, and strong hydrochloric acid without colour in the cold, but when allowed to boil the liquid becomes of a greenish tint, depositing a green resinous substance.

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We found the crystals obtained from a decoction of the plant to give off the odour of salicylol when heated with sulphuric acid and potassium dichromate, and we obtained some crystals in the ether extract of the plant, which also acted as a derivative of salicylic acid.

Enhydra fluctans, *Lour.*, Hilamochika or Hilamochi, (*Sans.*), Hingcha (*Beng.*), Harkuch (*Hind.*), a glabrous or pubescent marsh plant of Eastern Bengal and Silhet, with sessile, linear-oblong, acute or obtuse, entire or subcrenate leaves, from one to three inches in length, and with axillary or terminal, sessile flower heads; is used as a bitter vegetable in Bengal; and is considered to be laxative and useful in diseases of the skin and nervous system. The juice of the leaves in doses of about one tola (180 grains) is also prescribed.

This plant is unknown in Western and Southern India.

ECLIPTA ALBA, *Hassk.*

Fig.—*Lam. Ill., t.* 687; *Rheede, Hort. Mal. x.,* 41.

Hab.—Throughout India. The herb.

Vernacular.—Bhangra (*Hind.*), Bhengra (*Guz.*), Máka (*Mar.*), Kesuria (*Beng.*), Garaga, Kádige-garaga (*Can.*), Karesha-lánganni, Kaikeshi, Kaivishi-ilai (*Tam.*), Gunta-galijeru, Galagara-chettu, Gunta-kalagara (*Tel.*), Cajenneam (*Mal.*).

History, Uses, &c.—This is a very common weed in the rainy season, and may be found in irrigated fields and gardens at all times of the year; it is used by the Hindus at the Shraddh ceremony, being placed under and on the Pinda. It is called in Sanskrit Kesaraja, Bhringarája and Markava, names which include *Wedelia calendulacea*, which is regarded by the natives of India as a variety of *Eclipta alba*. In the Nighantas it is described as bitter, pungent, hot, and dry, removing phlegm and wind, increasing the appetite, and curing diseases of the skin, eye and head. In practice it is principally used as a tonic and deobstruent in hepatic and splenic enlargements, and in various chronic skin diseases; in

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the latter class of cases it is applied externally and given internally. The juice of the plant is used in tatooing to communicate a blue colour to the punctures, and it is stated in native works that when taken internally and applied externally it will dye the hair black. Mahometan writers follow the Hindus in their description of the medicinal properties of this herb, and give Kadim-el-bint as the Arabic name. Rheede states that a decoction is used for headache and toothache, and that the juice with melted butter is given in rheumatism. Pills made by pounding the plant with oil are supposed to relieve vertigo, and remove phlegmatic humors from the brain; whilst the leaves powdered and mixed with salt, pepper and limejuice, stimulate the appetite. He describes *Wedelia calendulacea* (x., 42,) as having similar properties. According to Dutt, the last-named plant is the Kesarája mostly used in Bengal, Ainslie also mentions it under the name of *Peela Bhangra*, and describes it in the following terms:—

"It has an herbaceous stem, a foot high, and nearly erect; leaves quite entire, opposite, lanceolate, bluntish, with yellow flowers, terminating, solitary, and on a very long peduncle. The leaves, seeds, yellow flowers, in a word the whole of this low-growing plant, which is pleasant and somewhat aromatic to the taste, is used in medicine; it is considered as deobstruent, and is prescribed in decoction, in the quantity of half a teacupful twice daily."

Mr. J. J. Wood suggested that *Eclipta alba* would be found eventually of greater service than taraxacum in hepatic derangements. The expressed juice is recommended as the best form for administration in the *Pharmacopœia of India*, and in Bombay the natives use the juice in combination with aromatics, such as ajowan seeds, as a tonic and deobstruent, and give two drops of it with eight drops of honey to new-born children suffering from catarrh. The plant is used in Madras to allay the irritation caused by scorpion sting. The leaves are rubbed from above the inflamed part down to the wound, and a paste is then made of the leaves and applied as a poultice.

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The following prescription is used in the Concan for tetanus:—Máka juice 1 tolá, juice of *Leucas zeylanica* (Tumba) ½ tolá, Ginger juice 2 tolás, juice of *Vitex trifolia* 1 tolá, leaf juice of *Sesbania grandiflora* 3 tolás; to be boiled with four times the quantity of cocoanut juice and a little rice and treacle to form a *Khir*, to be given twice a day.

Description.—*E. alba* is a small prostrate or ascending plant, stem reddish; leaves linear or oblong-lanceolate, attenuated at the base, with waved edges, 1 to 4 inches long. The whole plant is rough to the touch from the presence of numerous adpressed white hairs; the structure of these is peculiar, the base is red and turned upwards, and upon it is attached a conical, white, glandular hair. The flower heads are in pairs, axillary or terminal, ¼ to ½ of an inch in diameter, white or rarely yellow, one having a peduncle twice as long as the other; the receptacle is flat, and furnished with bristle-like scales between the florets, ray-florets fertile or sterile; disc-florets fertile, tubular; achenes of the ray-florets triquetrous, those of the disc compressed; pappus toothed or 2-aristate.

Wedelia calendulacea has a procumbent, glabrous or scabrid stem, 6 to 18 inches in length, rooting at the lower nodes; leaves 1 to 3 inches long, variable in breadth, sub-sessile, linear-oblong or oblanceolate, acute or obtuse, entire or subcrenate, hairs on both sides scattered, adpressed, rigid, white. Heads solitary, yellow, on long slender axillary peduncles, 1 to 1½ inches in diameter, outer involucre bracts large, oblong-obtuse, herbaceous, much longer than the disc-florets; outer florets ligulate, central tubular; achenes of the ray triquetrous, those of the disc compressed, pappus of toothed or hairy scales.

Chemical composition.—In addition to a large amount of resin, an alkaloidal principle was detected in *E. alba*, which we failed to obtain in a crystalline form. It afforded no special colour reactions. The sulphate was slightly soluble in ether. We provisionally call this alkaloid *Ecliptine*.

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GUIZOTIA ABYSSYNICA, *Cass.*

Fig.—*Wight Ill., t.* 132; *Bot. Mag., t.* 1017. Niger seed (*Eng.*).

Hab.—Africa, cultivated in India. The seed and oil.

Vernacular.—Rámtil, Kálátil (*Hind., Beng., Mar., Guz.*), Ulisi, Valesalu (*Tel.*), Uchellu (*Tam.*), Hutchu-ellu (*Can.*)

History, Uses, &c.—This plant is the *Núk* of the Abyssinians, and was first brought to the notice of Europeans by Bruce. (*Travels*, 1768—73.) It appears to have been introduced into India by the early Arabian traders, and was first brought to the notice of the English in India in 1800, when the seeds were sent to the Botanical Garden at Calcutta from the British Resident at the Court of the Berar Raja, and from Mr. Heyne at Bangalore, as those of a plant largely cultivated for the sake of the sweet oil obtained from the seeds. (*Roxb. Fl. Ind.*, iii. 441.) In the same year *Huts' Ellu*, or the *foolish oil plant*, was observed by Dr. Buchanan in Mysore. About the middle of August, after a heavy rain, the seed is sown broadcast, and ploughed in. It requires neither manure nor weeding, and is very exhaustive to the soil. It ripens in three months, when it is cut near the root and stacked for eight days. Then, having been for two or three days exposed to the sun, the seed is beaten out with a stick, and separated from fragments of the plant by a fan. Part of it is parched and made into sweetmeats with jaggery, but the greater part is sold to the oil-makers for expression. This oil is much esteemed for culinary purposes, and is also used as a lamp oil, but is reckoned by the natives inferior to that of Sesamum. About the same time it was noticed by Ainslie, who testified to its extensive cultivation on the coast. (*Mat. Ind.*, ii. 256.) Heyne notices its cultivation in Bengal and calls it *Werinnua.* (*Tracts on India*, p. 49.) The plant is cultivated on many parts of the table-land of India as a cold weather crop, and was first shipped to London from India in 1851. Allen (*Commercial Analysis*) classifies it in the cotton seed

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group of fixed oils, and states that its applications are to adulterate rape oil and to act as a substitute for linseed oil. We have not found it to be siccative enough for the latter purpose, and, in fact, from its sweetness and low congealing point, we should consider it of greater value than that usually attributed to it.

Description.—This is an annual, herbaceous, erect plant; leaves opposite, long, lanceolate, coarsely serrated, peduncles elongated, subcorymbose; flowers large, bright yellow.

The achenes are of a greyish-black colour, about $\frac{2}{10}$ of an inch long, somewhat angular from lateral compression, tapering towards the base, quite smooth, taste oily and nutty.

Chemical composition.—The seeds have been examined by Anderson who found them to contain water 7·02, oil 43·22, albuminous substances 19·37, sugar, gum, &c., 13·37, cellulose 14·33, ash 3·48 per cent. The nitrogen amounted to 3·10 per cent. (*Highland Agr. Soc. Journ., New Ser., No.* 69, *p.* 376.) The oil is light yellowish brown having a specific gravity of ·921 at 20° and ·924 at 15·5°. It solidifies at a temperature below zero. A few drops mixed with strong sulphuric acid form greenish brown clots. After the application of Massie's test the oil became light brown; heated with the acid, and after the action had ceased, the oil became dark reddish brown. It required 19 per cent. of KHO for saponification, and the fatty acids resulting from the decomposition amounted to 94·9 per cent. of the oil and melted at about 21° C. The fatty acids remaining at a temperature a little above their melting-point, separated into a solid white crystalline acid melting at 50° and some liquid oleic acid. By decomposing the lead soap of the fatty acids insoluble in ether, a white lustrous body was obtained melting at 54° and solidifying at 51°, and soluble in alcohol with a slight acid reaction, probably myristic acid. The oil has slight drying properties. About one and-a-half gram of oil was heated to a temperature of 92° in a shallow capsule for a few hours.

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each day and weighed carefully each morning before being heated. The greatest increase was observed on the second day, but the weight augmented daily in diminishing amounts until the fifteenth day, when it was found to have gained altogether 7·2 per cent. The oil was still unctuous and transparent and flowed from the vessel when inverted. The oil was heated to over 250° on three occasions, but this did not appear to affect its limpid character.

Glossocardia linearifolia, *Cass., Wight Ic., t.* 1110.

Syn.—*G. Bosvallea*, a plant of Central India and the Deccan, is known in Marathi by the name of *Phatar-suva*, which means *Rock anethum.* In the Poona and Sholapore districts it is called *Pitta-pápada*, a name also given to *Fumaria* as well as to several Acanthaceous plants. It is not sold in the Bombay shops, but is the Pitta-pápada of the Poona druggists, and according to Dalzell and Gibson is much used in female complaints, the nature of which they do not specify. *G. linearifolia* is a small annual, with many stems, diffuse; leaves alternate, much divided, linear at the base; heads of flowers solitary, yellow, on short naked peduncles. It has a bitter taste, and an odour of fennel, and is used as an emmenagogue.

ACHILLEA MILLEFOLIUM, *Linn.*

Fig.—*Woodville, t.* 15; *Reich. Ie. Fl. Germ., xvi. t.* 1026; *Bentl. and Trim,* 153. Yarrow, Nose-bleed (*Eng.*), Herbe aux Charpentiers, Millefeuille (*Fr.*).

Hab.—Western Himalaya. Cultivated in gardens.

Vernacular.—Biranjásif (*Ind. Bazars*).

History, Uses, &c.—Different species of Achillea have been used medicinally from a very early date, Dioscorides (iv., 34) mentions ἀχίλλειον as a plant which was used as an astringent and emmenagogue. According to Pliny the generic name was given to these plants because Achilles was the first to use them as a vulnerary, he says:—"Invenit et *achilleon* Achilles discipulus Chironis, qua vulneribus mederetur, quæ ob id

Achilleos vocatur. Hac sanasse Telephum dicitur. Alii primum æruginem invenisse, utilissimam emplastris, ideoque depingitur ex cuspide decutiens eam gladio in vulnus Telephi. Alii utroque usum medicamento volunt. Aliqui et hanc panacen heracleon, alii sideriten. Hanc apud nos *millefolium* vocant, cubitali scapo, ramosam, minutioribusque quam fœniculi foliis vestitam ab imo. Alii fatentur quidem illam vulneribus utilem, sed veram achilleon esse scapo cœruleo pedali, sine ramis." (25,19). A species of Achillea is the *Kaisum* of the Arabians, Ibn. Sina says of it:—قال جالينوس زهره ابلغ من الافسنتين (according to Galen its flowers are more conspicuous than those of wormwood). The same plant is the Biranjásib or Biranjásif of the Persians, which has been identified by Stocks with *A. santolina*, Linn.; the description of biranjásif in the *Tuhfat-el-muminin* is unmistakably that of an Achillea; another Persian name for the plant is *Bu-i-máderán*; it is in common use as a tonic in Persia and Sind. In Egypt a species of Achillea is used medicinally under the name of *Barbara* (بربرا). In Europe and in the East the plants belonging to this genus have long been considered to have stimulant, tonic, emmenagogue and antihæmorrhoidal properties. *A. Moschata* (Génepi blanc) is an Alpine plant with a musky odour, having sudorific and healing properties. At Engadine, in Switzerland, a volatile oil is extracted from it called Esprit d'Iva. For administration ½ oz. of *A. millefolium* may be infused in a pint of water and reduced to 6 oz., of this 1 oz. may be given every hour. This plant has of late years been reintroduced into medical use in America; it is spoken of as a general stimulant and tonic, with peculiar relations to the pelvic organs. Like other stimulant tonics, it has been found capable of curing certain cases of intermittent fever, and is apt to promote the appetite and digestion in atonic gastric disorders. Its special local action is illustrated by the virtues ascribed to it in piles and amenorrhœa, for the cure of which it was celebrated even in ancient times. The form of the first of these diseases, in which it appears to be most efficient, is that in which, along with relaxation of the sphincter ani, there is a discharge of mucus, more or less

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bloody, during defecation. A similar condition of atony in the reproductive organs of the female is attended sometimes with menorrhagia, and sometimes with imperfect and painful menstruation. A tonic and stimulant regimen is essential to its successful treatment, and as a portion thereof, milfoil may sometimes be employed with advantage. By this mode of action, doubtless, milfoil has proved beneficial in leucorrhœa and flatulent colic; and it may assist in curing relaxed and otherwise inert conditions of the throat, when its infusion is used as a gargle, or in cases of sore nipples, when it is applied as a lotion. The volatile oil may be given in doses of 20 drops.

Achilleïn, in doses of from 8 to 20 grains, is reported to have occasioned a sense of epigastric oppression and some irregularity of pulse, but to have increased the appetite. (*Stillé and Maisch.*)

Description.—A perennial herb with a slender creeping root-stock, giving off numerous filiform roots, and several long subterranean, reddish stolons with a blunt succulent scale at each node. Leaves alternate, the radical ones often 6 inches long, stalked, with a wide petiole, lanceolate-oblong in outline, the cauline ones much smaller, sessile and oblong, all very deeply bi- or tri-pinnatisect with closely placed, overlapping segments, which are again cut into linear, very acute lobes, more or less hairy, mucronate, and having small oil-glands on the lower side. The flowers grow in level-topped corymbs; heads numerous, with the involucre oblong; scales imbricate, keeled; receptacle flat, chaffy; ray-florets pistillate, 4 or 5, short ligulate, white or rose-coloured; disk-florets several, perfect, tubular, with the margin whitish and the tube greenish; achenes flattened, oblong, without pappus. It has a feeble aromatic somewhat chamomile-like odour, and a bitterish, rather saline taste.

Chemical composition.—Yarrow yields by distillation with water about $\frac{1}{10}$ per cent. of a blue or dark-green volatile oil, that of the flowers having a spec. grav. of 0·92, that of the leaves ·85 to ·92, the latter being butyraceous. The bitter principle

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achillein was obtained by Zanon (1846) as a reddish-brown extract-like mass, and was regarded by Von Planta (1870) as being identical with the alkaloid achilleïne of *A. moschata*. Zanon's *achilleïc acid* is aconitic acid (*Hlasiwetz*, 1857). Yarrow also contains a small quantity of resin, tannin, and gum, and various salts, consisting of malates, nitrates, phosphates, and chlorides of potassium and calcium; on incineration, from 13 to 17 per cent. of ash is obtained.

Von Planta-Reichenau (1870) obtained from *A. moschata* a bluish-green volatile oil, *ivaol*, of a refreshing odour and bitterish mint-like taste; *ivain*, $C^{24}H^{42}O^{5}$, soft, yellow, insoluble in water, soluble in alcohol and bitter; *achilleïne*, $C^{20}H^{38}N^{2}O^{15}$, is readily soluble in water, with difficulty in absolute alcohol, insoluble in ether, and when boiled with dilute acids yields sugar, ammonia, an odorous body, and *achilletine*, $C^{11}H^{17}NO^{4}$, which is dark-brown, insoluble in water, and not bitter; *moschatine*, $C^{21}H^{27}NO^{7}$, is insoluble in cold water, and has an aromatic bitter taste. (*Stillé and Maisch.*)

MATRICARIA CHAMOMILLA, *Linn.*

Fig.— *Lamk. Ill. t.* 678; *Bentl. and Trim. t.* 155. German Chamomile (*Eng.*), Camomille d'Allemagne (*Fr.*).

Hab.— Northern India, Persia, Europe.

Vernacular.— Bábune-ke-phúl (*Hind.*), Shimai-chámantippu (*Tam.*), Sima-chámanti-pushpamu (*Tel.*), Shima-jeventi-pushpam (*Mal.*), Shime-shyámantige (*Can.*), Bábuna-na-phúla (*Guz.*), Bábuna-cha-phúla (*Mar.*).

History, Uses, &c.—The ανθεμις of Dioscorides is referred by Sibthorp to *Anthemis chia*, Linn., but it is probable that several species were used under this name, including *Matricaria Chamomilla*. Theophrastes describes the flowers of *anthemon* as το δὲν κυκλω ανθος λευκον, το δὲν μεσω χρυσος (*H. P. vii.*, 13), his plant was therefore a single-flowered one. Formerly the chamomile flowers met with in the bazars were all obtained from Northern India and Persia, and were the flowers of *M. Cha-*

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momilla, but now the double flowers of *Anthemis nobilis* imported from Europe, are found in most of the large towns. The drug does not appear to be mentioned by the old Sanskrit writers, and was probably first used in India by the Mahometan invaders. The notices of Babunah in Persian works on Materia Medica must be understood as applying to *M. Chamomilla*; we gather from them that this plant is named after the village of Búbunah in Irák-arabi, where it is particularly abundant. The Arabs call it Tuffáh-el-ard and Shajrat-el-káfúr (camphor plant). It is considered to be stimulant, attenuant, and discutient. There is a popular opinion among the Persians that the odour of the flowers induces sleep and drives away noxious insects; they also say that bathing the genitals with chamomile tea has a powerful aphrodisiac effect.

Description.—The flower-heads are ½ to ¾ of an inch broad, and have a flattish involucre, with two or three rows of small oblong-linear, obtuse scales having the margin membranous. The receptacle is at first convex, but becomes strongly conical and hollow, and is free from chaff. The ray-florets are about fifteen in number, soon reflexed, white, ligulate-oblong, with two notches at the apex and enclosing the bifid style, but no stamens. The numerous yellow disk-florets are tubular, five-toothed, somewhat glandular, hermaphrodite, and have the anthers united into a tube through which the bifid style projects. The achenes are small, curved, finely five-ribbed on the inner surface, brownish, without pappus, but with a slightly elevated margin at the apex. German chamomile-flowers have a peculiar aromatic odour and a bitterish aromatic taste. They are easily distinguished from allied composite plants by their smooth, conical, and hollow disks, which shrink very considerably on drying.

Chemical composition.—German chamomile-flowers contain about ¼ per cent. of volatile oil, some bitter extractive, malates, tannates, and a little tannin, besides the principles common to vegetables. Pattone's *anthemic acid*, isolated (1859) from *Anthemis arvensis*, Linn., was obtained by Werner (1867) from

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the officinal flowers by exhausting them with hot water acidulated with acetic acid, concentrating, precipitating with alcohol, evaporating the filtrate, and treating with chloroform. It is described as colourless silky needles having an agreeable odour of chamomile, a strongly bitter taste, and dissolving in water, alcohol, ether and chloroform. The precipitate obtained with alcohol is stated to contain a tasteless crystalline principle, *anthemidin*, which is insoluble in alcohol, ether, and chloroform, but soluble in acetic acid.

The volatile oil is a dark blue, in thin layers transparent thickish liquid, which gradually turns green and brown when exposed to light and air, and more rapidly if obtained from dried flowers; it has a strong odour of the flowers and a warm aromatic taste; dissolves in about 8 parts of 80 per cent alcohol, has the specific gravity 0·93, and seems to consist of a terpene, $C^{10}H^{16}$, associated with $C^{10}H^{18}O$. The volatile oil becomes dark-brown, or green with strong or diluted nitric acid, and deep red-brown with sulphuric acid. The blue colour is due to the presence of a volatile principle which was named *azulene* by Piesse and *cærulein* by Gladstone (1863), and which according to both investigators, is present in all other volatile oils having a blue or green colour—in the latter associated with a yellow principle. (*Stillé and Maisch.*)

Chrysanthemum coronarium, *Linn.*, *Lam.*, *Ill. t.* 678, *f.* 6, a native of the Mediterranean region, is commonly cultivated in Indian gardens, and is a favourite flower with both Hindus and Mahometans. It blossoms in the cold season, and there are two distinct varieties, one with large flowers, and another with small. The flowers are of various colours, and when dried impress a peculiar pricking sensation on the tongue like pyrethrum. Dalzell and Gibson (*Bombay Flora ii.*, 48,) state that they are a tolerable substitute for chamomile. According to Dr. Walker (*Bombay Med. and Phys. Trans.*, 1840, *p.* 71,) the people of the Deccan administer the plant in conjunction with black pepper as a remedy for gonorrhœa. The vernacular names are, Gul-dáúdi (*Hind.*, *Beng.*, *Guz.*), Shaman-

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tippu (*Tam.*), Chemanti (*Tel.*), Jevanti-puva (*Mal.*), Shyavan-tigehuvu (*Can.*), Shevanti-cha-phula (*Mar.*).

Centipeda orbicularis, *Lour.*, *Wight Ic.* 1610, a native of the plains of India and Ceylon, is used as a mechanical sternutatory by the natives; it is administered to relieve headache and colds in the head like *Artemisia Ptarmica*, Linn., the sneezewort of the English. In Sanskrit it is called Chikkana or Chhikika, which is equivalent to sneezewort, and the vernacular names have a similar meaning. According to Roxburgh this plant appears during the latter part of the cold season, on cultivated land. The whole plant does not cover a space more than about 6 to 8 inches in diameter. The root is simple, the stems several, branchy, pressing on the earth; all are somewhat woolly; leaves numerous, sessile, wedge-shaped, deeply dentate, villous; flowers axillary or in the divisions of the branches, solitary, sessile, sub-globular, hermaphrodite, florets from 10 to 12 in the centre with the border 4-toothed, coloured and expanding; the female ones very numerous in the circumference, most minute, with the border seemingly 3-toothed, and the toothlets incurved. Receptacle naked.

ANACYCLUS PYRETHRUM, *DC.*

Fig.—*Woodville, t.* 20; *Reich. Ic. Fl. Germ. t.* 999; *Bentl. and Trim. t.* 151. Spanish Pellitory (*Eng.*), Salivaire d'Espagne (*Fr.*).

Hab.—North Africa. The root.

Vernacular.—Ákarkara, Akalkara (*Hind, Beng., Mar.*), Akkirakaram (*Tam.*), Ákala-karra (*Tel.*), Akkikaruka (*Mal.*), Ákalakari (*Can.*), Akarkaro (*Guz.*).

History, Uses, &c.—Pellitory root, in Sanskrit Akará-karabha, is only mentioned by the later writers, such as Sarangadhara and the author of the *Bhavaprakasa*, who have doubtless derived their knowledge of its properties from the Mahometans, who in their turn closely follow the Greeks.

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The only difficulty is that πύρεθρον is described by Dioscorides as an umbelliferous plant; but with the properties of pellitory; here the author of the *Makhzan* comes to our aid and tells us that the pyrethrum of Dioscorides resembling anethum is a drug which the Arabs call Ud-el-karih-jibbali, very common in Syria; it is found at the upper part of Wady Pardah, and, he says, I have seen its fruit; it has a root about a span in length, as thick as the finger, and has many of the properties of pyrethrum. He also quotes Antaki* as mentioning two kinds of pyrethrum, *viz.*, Western, or the kind described by Ibn Baitar, and Syrian called Ud-el-karih, which is the root of the mountain Tarkhún and the kind described by Dioscorides (*Smyrnium cordifolium*, Boiss.). We also learn from the *Makhzan* that طرخون is an Arabic form of ترخون the name of a plant common in Persia, especially in Fars and about Shiraz; it is eaten like cress and other herbs with bread and cheese. There are two kinds, wild and cultivated; it is propagated by seed and by cuttings, and has a hot, astringent and sweetish taste; if taken fasting it benumbs the tongue; on this account it is chewed to cover the taste of nauseous medicines. The taste is likened to that of the leaves of the Woodapple (*Feronia elephantum*). The root of the wild plant is called Akarkarha. Ainslie, speaking of Pellitory root, says:—"This root is to be found in most of the Indian bazars; though I cannot learn that the plant grows in any part of India. It is a native of Arabia, Syria, Calabria, Crete, and Bohemia,† and it is, no doubt, from the first-mentioned of these countries that it is brought to Hindustan, an export from Mocha. I am much inclined to think that it is the root we find noticed by Forskahl in his *Materica Medica Khairina* under the name of Ud-el-karih. With regard to its Asiatic names, there is this peculiarity, that its Arabic, Persian

* Sheik Dawood of Antioch, his work is in Arabic, and has been printed at Beyrout.

† The plant alluded to by Ainslie as growing in these localities must be *Anacyclus officinarum*, Hayne, or German Pellitory. It is certainly not the Pellitory imported into India, being much smaller.

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and Dakhanie appellations are nearly the same. The pungency of the pellitory root is not perceived till it has been chewed for a few seconds, when it occasions at first a glowing heat in the mouth soon followed by pricking sensation in the tongue and lips. The Vytians prescribe an infusion of it, in conjunction with the lesser galangal and ginger, as a cordial and stimulant in lethargic cases, in palsy, and in certain stages of typhus fever; they also order it to be chewed, as a masticatory, for the toothache. It certainly possesses powerful stimulant properties, but is scarcely ever employed in Europe as an internal remedy; though it has been found useful as a sialagogue, and as such, Dr. Thomson says, has been given with success in some kinds of headache, apoplexy, chronic ophthalmia, and rheumatic affections of the face." (*Mat. Ind.* I., 300.) Mahometan writers consider pellitory to be discutient and attenuant; they prescribe it chiefly in paralytic affections, which they suppose to be caused by phlegmatic humours. The Arabic name Akarkarha* is said to be derived from Akar and takrih, and to mean 'causing a sore.' Celsus mentions its use for opening the mouths of wounds. (*Lib. v., cap. iv.*) The Arabian physicians in the days of Avicenna prescribed pellitory in rigors. In India it is often given to parrots to make them talk.

Description.—The root as found in the shops is simple, 3 to 4 inches long by $\frac{3}{8}$ to $\frac{4}{8}$ of an inch thick, cylindrical or tapering, sometimes terminated at the top by the bristly remains of leaves, and having only a few hair-like rootlets. It has a brown, rough, shrivelled surface, is compact and brittle, the fractured surface being radiate and destitute of pith. The bark, at most 1-25th of an inch thick, adheres closely to the wood, a narrow zone of cambium intervening The woody column is traversed by large medullary rays in which, as in the barks, numerous dark resin-ducts are scattered. The root has a slight aromatic smell, and a persistent, pungent taste, excit-

* It is also said by some to be a Coptic word, and by others supposed to be of Indian origin.

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ing a singular tingling sensation, and a remarkable flow of saliva. The drug is very liable to the attacks of insects.

Microscopic structure.—The cortical part of this root is remarkable on account of its suberous layer, which is partly made up of sclerenchyme (thick-walled cells). Balsam-ducts (oil cells) occur as well in the middle cortical layer as in the medullary rays. Most of the parenchymatous cells are loaded with inulin; pellitory, in fact, is one of those roots most abounding in that substance.

Chemical composition.—Pellitory was first analysed by Parisel, who gave the name *Pyrethrin* to a soft resin soluble in alcohol and ether. Koene subsequently found in the root a resin, brown acrid oil, yellow oil, inulin, gum, salts and a trace of tannin. The two oils and resin together were said to constitute the pyrethrin of Parisel, and the active principle has consequently been regarded as a mixed substance. C. J. S. Thompson (*Pharm. Journ.* [3], xvii. 567,) finds the active principle to be an acrid resinous substance, residing mostly in the cortical portion, and occurring to the extent of 5 per cent. in good samples of root. A very minute quantity placed on the tongue causes a strong burning sensation, which shortly increases, and remains for a considerable time, inducing a copious flow of saliva. A strong solution painted on the skin causes a sharp prickling sensation, and reddens the part where it has been applied. If the part is kept covered a blister will be produced. Besides being soluble in alcohol and ether, it dissolves in oils and acetic acid. It is composed of an acrid, brown resinous substance soluble in alcohol, but insoluble in water and strong alkaline solutions; and a dark yellow oil which is soluble in alkalies. The acridity of the oil is probably due to a small quantity of resin mixed with it.

R. Buchheim has recently claimed to have found the active principle to be a crystalline alkaloid, *Pyrethrine,* which he obtained by evaporating to dryness an alcoholic extract and exhausting the residue with ether. Pyrethrine melts at the heat of the body, and is resolved by alcoholic potash into piperidine and pyrethric acid. (*Arch. f. Experim. Path.* 5., p. 458.)

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Commerce.—The root is collected chiefly in Algeria, and is exported from Oran, and to a smaller extent from Algiers. But from information obtained by Flückiger and Hanbury from Colonel Playfair, British Consul-General for Algeria, and from Mr. Wood, British Consul at Tunis, it appears that the greater part is shipped from Tunis to Leghorn and Egypt. Mr. Wood was informed that the drug is imported from the frontier town of Tebessa in Algeria into the regency of Tunis, to the extent of 500 cantars (50,000 lbs.) per annum. Bombay imported in the year 1871—72, 740 cwts. of this drug, of which more than half was re-shipped to other ports of India. (*Pharmacographia.*) Pellitory root is valued in Bombay at about Rs. 24 per maund of 37½ lbs. The quantity imported hardly varies from year to year.

TANACETUM UMBELLIFERUM, *Boiss.*

Syn.—*Pyrethrum umbelliferum, Boiss. Fl. Or. i., p.* 352.

Hab.—Eastern Persia. The root.

Vernacular.—Mitha-akarkara, Bozidán (*Indian Bazars*).

History, Uses, &c.—This plant was found by Aitchison in the Badghis and Harirud valley. The roots are collected and sold in India as "Mitha-akarkara," "Sweet Pellitory," and are used by the Mahometan physicians as Bozidán. The latter name, as we have already mentioned (Vol. ii., p. 137), is of Persian origin, and is applied like Shakákul to several stimulating and nutritious roots mostly used by women for improving their *embonpoint*. The hakims consider it to be aphrodisiac, tonic, deobstruent, useful in rheumatism and gout, and in enlargement of the liver and spleen. They also state that it has abortifacient and anthelmintic properties.

Description.—Root 6 to 10 inches long, closely resembling that of pellitory in appearance, tapering, somewhat twisted. It has a brown, rough, shrivelled surface, is compact, and breaks with a short fracture, showing a radiate surface and small central pith. The bark adheres closely to the wood.

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The drug has the faint aromatic odour of pellitory, but is almost free from pungency.

Chemical composition.—A proximate analysis of the powdered root separated, ether extract 1·0, alcoholic extract 8·6, water extract 25·1, crude fibre 56·9, and ash 6·8 parts in one hundred. The ether extract, having a distinct odour of chaulmoogra oil, was evaporated to dryness and digested in rectified spirit for several months; this separated a whitish insoluble granular fatty substance, and a light reddish brown liquid. The insoluble portion examined under a microscope was seen to consist of radiating crystalline tufts of wax, tasteless, and neutral in reaction, dissolving to some extent in boiling alcohol and solidifying in the cold; soluble in petroleum ether; it softened a little above 70°; at the temperature of boiling water it melted to a brown liquid, and with a sufficient heat, it burnt away on platinum foil with a smoky flame. The soluble portion of the ether extract was evaporated, and the fatty residue was acid in reaction, and produced a numbing sensation on the tongue and at the same time caused a flow of saliva. Petroleum ether removed a fatty acid from this residue and left a soft brown resin. This resin had the characters of pyrethrin. Besides its action on the tongue, it was soluble in ether, proof spirit, chloroform and bisulphide of carbon and insoluble in caustic and carbonated alkalies. Nitric acid decomposed it with evolution of gas. Sulphuric acid dissolved it with a red-brown colour and the mixture developed an odour of butyric acid.

The alcoholic extract of the root contained an organic acid, some saccharine matter reducing Fehling's test, but no alkaloid. The acid was deepened in colour with ferric chloride, gave an orange precipitate with plumbic acetate, but produced no deposit in solution of gelatine.

The water extract contained 15 per cent. of a carbohydrate forming a pulverulent precipitate with three volumes of alcohol.

Sweet Pellitory thus contains very little pyrethrin compared with the amount found in the Pellitory of Spain, and less inulin.

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It is more woody, and its name probably refers not so much to the amount of sugar it contains as to the small quantity of acrid and pungent principle.

SPILANTHES ACMELLA, *Linn.*

Fig.—*Wight Ic., t.* 1109. Para Cress (*Eng.*), Cresson de Para (*Fr.*).

Hab.—Throughout India. The flower heads.

Vernacular.—Pipulka (*Mar.*), Vana mugali (*Can.*). It bears the same names as *Pyrethri Radix* in the vernaculars.

History, Uses, &c.—Four forms of this plant are noticed in the *Flora of British India,—S. proper, S. calva, S. oleracea,* and *S. paniculata.* Of these *S. oleracea, Jacq. Hort. Vind ii., t.* 135, is a cultivated form common in Indian gardens, and *S. paniculata* is also, in the opinion of Sir J. D. Hooker, a form produced by cultivation. The cultivated forms are chiefly remarkable for their more robust and succulent habit, and in *S. oleracea* for larger and more highly-coloured flower heads: the latter plant is the true Cresson de Para, and is supposed to have been introduced into India from Brazil by the Portuguese. The flower heads of these plants are by far the most pungent part, and are chewed by the natives to relieve toothache, which they do by producing redness of the gums and salivation. Dr. W. Farquhar has used and recommended a tincture of the flower heads for toothache in place of tincture of pyrethrum. He says it is a specific for inflammation of the periosteum of the jaws. A bit of lint dipped in the tincture and laid on the gums repeated 3 or 4 times a day has a speedy effect in reducing the pain and swelling. Graham, on the authority of Dr Lush, states that *S. oleracea* is cultivated in the Deccan as a pot-herb, and the same fact was observed by Dr. Mason in Burma. *S. Acmella proper* has been sent to us from the Western Ghauts under the Marathi name of *Pipulka* as a fish poison in general use on those hills.

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Description.—Small annual plants with round, smooth, succulent, branching stems; leaves opposite, petioled, subcordiform, subdentate. The flower heads are solitary at the end of pedicels longer than the leaves, of a conical form, and in *S. oleracea* as large as an acorn; they are entirely composed of yellow or brownish yellow hermaphrodite tubular flowers. The achenes are compressed with ciliated margins, and are surmounted, except in *S. calva*, by two naked awns. The whole plant is pungent to the taste, but the flower heads are especially so, having a hot burning taste which causes profuse salivation.

Chemical composition.—Gerrard has analysed this plant with the result that the active principle is an oleo-resin with powerfully sialagogue properties. (*Pharm. Journ. March* 8, 1884, *p.* 717.) R. Buchheim has found in the herb the crystalline alkaloid obtained by him in Pellitory root (*see* article *Anacylus Pyrethrum*). We have made a full examination of the flower heads of *Spilanthes calva*, which are used as a substitute for pellitory in some parts of India, and we find them to contain the following constituents: a resin, fixed oil, yellow colouring matter, astringent organic acid, glucose, extractive with the odour and taste of malt and 7·6 per cent of mineral matter. The resin had the reactions possessed by pyrethrin in being soluble in ether, alcohol and proof spirit, insoluble in alkalies and destroyed by oxidizing agents. In these respects it resembles the pungent principle of plants found in the *Zinziberaceæ*. We were unable to obtain it in a crystalline condition. The flower heads distilled with water afforded a distillate free from pungency, and the contents of the retort after boiling were likewise inert. The active principle is unstable in constitution and decomposed by heat.

ARTEMISIA VULGARIS, *Linn.* var. *indica*.

Fig.—*Wight Ic., t.* 1112; *Rheede Hort. Mal. x., t.* 45. Wormwood (*Eng.*), Armoise, Herbe de Saint-Jean (*Fr.*).

Hab.— Throughout the mountainous districts of India. The herb.

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Vernacular.—Nágdoun, Mastáru (*Hind.*), Nágdoni (*Beng.*), Surband, *vulg.* Surpan (*Mar.*), Máchipatri *(Tel.)*, Máchipattiri (*Tam.*), Tiru-nitripachcha (*Mal.*), Uruvalu, Urigattige (*Can.*), Nágadavano (*Guz.*).

History, Uses, &c.—There appears to be a difference of opinion as to the Sanskrit name of this plant. In Northern India and Bengal it is identified with the Nágadamani of the Nighantas, a plant which is described as a tonic and counteracting the poison of spiders and snakes. In the Deccan and Western India the Sanskrit name is said to be Indhana, although the local version of the Rája-nighanta gives Nágdavana as the Marathi equivalent of Nágadamani, a name generally applied in that language to *Crinum asiaticum.* According to Moodin Sheriff, the Sanskrit name in Southern India is Granthiparni. These names are not synonymous, and as the plant is common in all parts of the country, this discrepancy would seem to indicate that its mention by the older Sanskrit writers is very doubtful. The modern Hindus consider wormwood to be a valuable stomachic, deobstruent and antispasmodic, and prescribe it in infusion and electuary in cases of obstructed menses and hysteria. *A. vulgaris* is generally considered to be the Artemisia of the Greeks, a name generally derived from the lunar goddess Artemis, who is supposed to have been the discoverer of its virtues, but Pliny says:—"Sunt qui Artemisiam ab Artemide Ilithya cognominatam putent, quoniam privatim medeatur fœminarum malis."

Macer Floridus in his treatise, *De viribus herbarum*, calls wormwood *herbarum matrem*, and attributes to it emmenagogue, antilithic and alexipharmic properties; he also says that it assists parturition and prevents abortion. Apuleius *De virtutibus herbarum* states that a person carrying wormwood will be preserved from fatigue, hidden demons and the evil eye. "Tres artemisias," says he again, "Diana dicitur invenisse et virtutes earum et medicinam Chironi centauro tradidisse, qui primus de his herbis medicinam instituit." There is a popular superstition at Bologna that wormwood will indicate the ter-

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mination of a disease; a bunch of the leaves is surreptitiously placed under the sick person's pillow, if, after this he sleeps, he will soon get well; if not, he will die. (*De Gubernatis.*)

A. vulgaris is probably one of the kinds of Afsantin (αψίνθιον) described by Mahometan physicians, but owing to the want of a sufficient description of these drugs, it is impossible to identify it. Dr. Wight (*Ill.. ii*, 92,) notices its use in nervous and spasmodic affections, and Dr. J. L. Stewart speaks of an infusion as a good mild stomachic tonic.

Artemisia Sieversiana, *Willd.*, is one of the kinds of Afsantin sold in Indian bazars. It is imported from Persia, and has for many years been cultivated at Bandora, in the neighbourhood of Bombay, for the sake of the fresh herb, which is always obtainable in the market, and is much valued by the natives. The cultivation appears to have been in the hands of a few Christian families for several generations; they also cultivate Sweet Marjoram. The two plants are called *Azarona* and *Mazarona* by the native Christians, and were no doubt introduced into the country by the Portuguese. Medicinally it is esteemed as a tonic, deobstruent, febrifuge, and anthelmintic, and it is applied externally as a discutient and antiseptic. The hakîms prescribe it in hypochondriasis, jaundice, dropsy, gout, scurvy, &c.; also as an emmenagogue, and in hysterical affections.

Description.—*A vulgaris* is erect, suffruticose; leaves ashy and tomentose beneath, lower pinnatifid, upper trifid, uppermost undivided or with lanceolate lobes; lobes of the lower leaves toothed or cut; heads of flowers racemose-panicled, ovate; panicle leafy, spreading, partial racemes pendulous before flowering, young involucre a little tomentose, at length glabrous; exterior scales foliaceous, acute, interior membranaceous, obtuse; corol naked. (*Roxb. Fl. Ind. iii.*, 419.)

A. Sieversiana is annual or biennial, hoary-pubescent, stem erect, angled and ribbed, simple or paniculately branched above; leaves mostly petioled, broadly ovate, 2-pinnatisect, segments obtuse and obscurely lobed, hoary on both surfaces, heads ¼ to

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nearly ½ inch in diameter, broadly hemispheric, pedicelled, secund, nodding, distant, in lax, long racemes terminating the branches, outer involucre bracts green hoary, inner broadly scarious, receptacular hairs long, straight. (*Fl. Br. Ind.*)

Chemical composition.—The Wormwoods contain absinthate of potash, a bitter substance, and a green volatile oil having a camphoraceous odour. *Absinthin* ($C^{16}H^{22}O^{5}$), the bitter principle is prepared, according to Luck, by exhausting the leaves with alcohol, evaporating to the consistence of a syrup, and agitating with ether. This ethereal solution is evaporated to dryness, and the residue treated with water containing a little ammonia, which dissolves the resin, and leaves the absinthin nearly pure. To complete the purification it is digested with weak hydrochloric acid, washed with water, dissolved in alcohol, and treated with acetate of lead, as long as a precipitate is formed. After the removal of this precipitate by filtration, the excess of lead is precipitated by sulphuretted hydrogen, and the solution is evaporated. The absinthin then remains as a hard confusedly crystalline mass, possessing an extremely bitter taste. It is but slightly soluble in water, very soluble in alcohol, and less so in ether. It possesses distinctly acid characters, and is dissolved by potash and ammonia. The *Sal Absinthicum* of the old Pharmacopœias was nothing more than carbonate of potash obtained by incineration of the plant. *Absinthol*, $C^{10}H^{16}O$, isomeric with ordinary camphor, is the essential constituent of Wormwood oil, in which it is associated with a terpene, boiling below 160°, and a deep blue oil which boils between 270° and 300°, and agrees in its properties with the blue chamomile oil examined by Kachler. Absinthol boils at 195° (*Beilstein and Kupffer*); at 200—205° (*Alder Wright*); 217° (*Gladstone*). It differs essentially from camphor in its chemical reactions, not being converted into camphoric acid by oxidation with nitric acid, or into camphocarboxylic acid by the action of sodium and carbonic anhydride, and yielding when fused with potash, a large quantity of resin, but no acid. Heated with phosphorus pentasulphide, it yields a considerable quantity of cymene, $C^{10}H^{14}$, identical with ordinary cymene

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from camphor or from cumin oil in density and the properties of the sulphonic acid derived from it. (*Alder Wright.*) Cymene is also formed, though in smaller quantity, by treating absinthol with zinc chloride.

Commerce.—Afsantin is imported from Persia; the entire plant is found in the bales, and owing to its toughness, is seldom much broken.

Value.—Rs. 5 to Rs. 7 per Surat maund of 37½ lbs.

Artemisia vulgaris is not an article of commerce.

ARTEMISIA MARITIMA, *Linn.*

Fig.—*Bentl. and Trim., t.* 157. Wormseed (*Eng.*), Semencine, Barbotine (*Fr.*).

Hab.—Northern Asia. The flower heads.

Vernacular.—Kirmáni-ajamo (*Guz.*), Kirmáni-ova (*Mar.*), Shih (*Arab.*), Kirmálá (*Hind.*).

History, Uses, &c.—The Sanskrit name of this plant is said by some to be Gadádhara, but it appears in the Nighantas under the name of Javániya "Grecian," with the Hindi synonym Kirmálá, evidently a corruption of Kirmán, the name of the province in Persia from which it is imported into India; it is described as a vermicide. *A. maritima* is the σερίφον and αψίνθιον θαλλασσίον of Dioscorides, and was used by the Greeks and Romans to expel intestinal worms. It was probably first known in Egypt, as Pliny states that those initiated in the mysteries of Isis used to carry a branch of it in their hands. Arabian and Persian physicians describe wormseed under the name of Shíh, givign as synonyms, Sarifún and Afsantin-el-bahr; it is prescribed in doses of 2 to 3 dirhems as an anthelmintic, and also as a deobstruent and stomachic tonic. In the form of a poultice they use it to relieve the pain caused by the bites of scorpions and other venomous reptiles. The Persian name is Darmanah. The wormseed of the Indian market has been examined by Hanbury, who considers that it does not materially differ from the Russian drug, but is slightly shaggy and mixed with

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tomentose stalks. He states that a specimen of Artemisia, No. 3201, Herb. Griffith, Afghanistan, in the Kew Herbarium, has capitules precisely agreeing with the Bombay drug.

Santonin is now well known to the natives of India, and is largely imported from Germany. It is generally considered to act as a poison upon ascarides, but according to Dr. von Schrœder (*Arch. f. exp. Path.*, xix., 290) this is not the case. He states that the santonin does not kill these worms, but its presence being distasteful to them, causes them to leave their resting place and wander into the large intestine, from which they can then be removed by a purgative. This should determine the time for giving a purgative, and Dr. von Schrœder thinks it should either be given with the santonin, or else some hours after. We have obtained very good results by giving half the dose at bed-time, and the remaining half next morning with a dose of castor-oil.

Description.—The drug consists almost exclusively of unopened flower heads or capitules, which are so minute that it requires about 90 to make up the weight of one grain. In inferior samples, there is an admixture of stalks, and portions of a small pinnate leaf. The flower heads are of an elliptic or oblong form, about 1-10th of an inch long, greenish yellow when new, brown if long kept; they grow singly, less frequently in pairs, on short stalks, and are formed of about 18 oblong, obtuse, concave scales, closely imbricated. This involucre is much narrowed at the base in consequence of the lowermost scales being considerably shorter than the rest. The capitule is sometimes associated with a few of the upper leaves of the stem, which are short, narrow, and simple. Notwithstanding its compactness, the capitule is somewhat ridged and angular from the involucral scales having a strong central nerve or keel. The middle portion of each scale is covered with minute yellow, sessile glands, which are wanting on the transparent scarious edge. The latter is marked with extremely fine striæ, and is quite glabrous: in the young state and in the Bombay variety of the drug, the keel bears a few woolly colourless

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hairs. The florets number from 3 to 5; they have in the bud an ovoid corolla, glandular in its lower portion, a little longer than the ovary, which is destitute of pappus. Mahometan writers name several varieties of wormseed, but do not describe them with any minuteness. It would seem then that we must be prepared to meet with slight differences in packages of the commercial article, but in any case the drug should have a powerful and agreeable odour resembling cajuput oil and camphor, and a bitter aromatic taste.

Chemical composition.—Wormseed yields from 1 to 2 per cent. of essential oil, having its characteristic smell and taste. The oil is slightly levogyrate, and chiefly consists of the liquid $C^{10}H^{18}O$, accompanied by a small amount of hydrocarbon. The former has the odour of the drug, yet rather more agreeable; sp. gr. 0·913 at 20° C. It boils without decomposition at 173° to 174°, but in presence of P^2O^5 or P^2S^5 abundantly yields cymol. The latter had already been observed by Völckel (1854) under the name of *cynene* or *cinene*, yet he assigned to it the formula $C^{12}H^9$; Hirzel (1854) called it cinæbene. The water which distils over carries with it volatile acids of the fatty series, also *angelic acid.*

The substance to which the remarkable action of wormseed on the human body is due, is Santonin, $C^{15}H^{18}O^3$. It was discovered in 1830 by Kahler, an apothecary of Düsseldorf, who gave a very brief notice of it in the *Archiv. der Pharmacie* (xxxiv., 318). Immediately afterwards, Augustus Alms, a druggist's assistant at Penzlin, in the Grand Duchy of Mecklenburg-Schwerin, knowing nothing of Kahler's discovery, obtained the same substance, and named it Santonin. Alms recommended it to the medical professon, pointing out that it is the anthelmintic principle of wormseed. Santonin constitutes from 1½ to 2 per cent. of the drug, but appears to diminish in quantity very considerably as the flowers open. It is easily extracted by milk of lime, for though not an acid, and but sparingly soluble in water even at a boiling heat, it is capable of combining with bases. With lime it forms santoninate of

calcium, which is readily soluble in water. On addition of hydrochloric acid, santoninic acid, $C^{15}H^{20}O^{4}$, separates, but parts with OH^{2}, Santonin being thus immediately reproduced.

Santonin forms crystals of the orthorhombic system melting at 170°, which are inodorous, but have a bitter taste, especially when dissolved in chloroform or alcohol. They are colourless, but when exposed to daylight, or to the blue or violet rays, but not to the other colours of the spectrum, they assume a yellow hue, and split into irregular fragments. This change, which takes place even under water, alcohol or either, is not accompanied by any chemical alteration. This behaviour of Santonin, when exposed to light, resembles that of erythrocentaurin, $C^{27}H^{24}O^{8}$. The latter has been obtained by means of ether, from the alcoholic extract of *Erythræa Centaurium*, and of some other plants of the Gentianaceæ. Mehu has shown that the colourless crystals of that substance, when exposed to sunlight, assume a brilliant red colour, without undergoing any chemical alteration. The colourless solutions of this body in chloroform or alcohol yield the original substance. Yet as to Santonin, Sestini and Cannizzaro (1876) have shown that its dilute alcoholic solution, on long exposure to sunlight, affords a compound ether of photo-santonic acid, namely, $C^{15}H^{13}O^{4}(C^{2}H^{5})^{2}$.

Wormseed contains in addition to the two bodies just described, resin, sugar, waxy fat, salts of calcium and potassium, and malic acid; when carefully selected and dried, it yielded us 6·5 per cent. of ash, rich in silica. (*Pharmacographia*, 2nd Ed., p 389.) Wormseed oil has been investigated (1884) by Messrs. Hell, Sturcke and Ritter, and Messrs. Wallach and Brass. The latter authors confirm the statements of previous observers that the principal constituent of *oleum cinæ* is a compound having the composition $C^{10}H^{18}O$, which, as being an isomer of Borneol, they propose to call '*Cyneol*'; and that this is accompanied by a certain quantity of hydrocarbons with a similar boiling point. But they have also met with another compound richer in oxygen, and having a higher boiling point. Pure cyneol is a liquid having a characteristic but not dis-

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agreeable camphor-like odour boiling at 176° to 177° C., and having a specific gravity of 0·92297 at 16° C. It is optically inactive, though the rectified oil from which it is obtained has been found to have a rotation to the left of 2°·9, due to other constituents boiling at higher temperatures. Oxidised by boiling with nitric acid, cyneol yielded besides the lower fatty acids essentially oxalic acid, but no acid of the aromatic series; while the hydrocarbons ($C^{10}H^{16}$ and $C^{10}H^{14}$) accompanying it in the oil yielded upon oxidation always more or less toluylic or terephthalic acid. Cyneol by treatment with gaseous hydrochloric acid is converted into a hydrocarbon ($C^{10}H^{16}$), to which the name '*Cynen*' has been given.

Commerce.—Wormseed is brought to India from Afghanistan and Persia in considerable quantities. Value, Rs. 2½ to Rs. 3 per Surat maund of 37½ lbs. Santonin is now largely imported into India; much of that sold in the bazar is adulterated to the extent of three-fourths of its weight with various substances, amongst which gum and boracic acid have been noticed. An easy test is to expose it to sunlight, which turns the santonin yellow.

DORONICUM PARDALIANCHES, *Linn.*

Fig.—*Jacq. Austr., t.* 350. Leopard's bane (*Eng.*), Doronic (*Fr.*).

Hab.—Europe, Syria. The rhizome.

Vernacular.—Darúnaj-i-akrabi (*Pers., Ind. bazars*).

History, Uses, &c.—*D. pardalianches,* according to Sibthorp, is called σκορπίδι in modern Greek. He identifies it with the ακονίτον of Dioscorides (iv., 75), which that writer describes as having a root like the tail of a scorpion and white like alabaster. Theophrastus (vi. 3. ix. 14) calls it θηλύφονον and σκορπίος and Pliny (25; 75) Thelyphonon and Scorpio. The author of the *Makhzan-el-Adwiya* states that Darúnaj is a scorpioid knotted root with a greyish exterior and white interior, that it is hard, faintly bitter and aromatic. He de-

scribes the plant as having fleshy yellowish leaves of the shape of those of the almond, which lie flat upon the ground. The flower stem he says is hollow; it rises from the midst of the leaves to a height of two spans, and bears from 5 to 7 scattered leaves, thinner and longer than the lower leaves. The flower is yellow and hollow. The plant grows in Andalusia and the mountainous parts of Syria, especially about Mount Yabrúrat, where it goes by the name of Akrabi. There are two varieties of the drug, Persian and Turkish; the latter is most esteemed. With regard to its medicinal properties, he says that it is a resolvent of phlegm, adust bile, and flatulencies, cardiacal and tonic, useful in nervous depression, melancholy, and impaired digestion, also in pain of the womb, and flatulent dyspepsia.

Besides this it is prescribed for persons who have been bitten by scorpions and other venomous reptiles, and is hung up in houses to keep away the plague; pregnant women wear it round the waist suspended by a silken thread which must be made by the wearer; it is supposed to act as a charm, protecting the fœtus and procuring a painless delivery. Hung up over the bed it prevents night terrors and ensures pleasant dreams. There would appear to be a demand for it in India, as it is kept by all Mahometan druggists.

Description.—Rhizomes scorpioid, occasionally branched, flat, jointed, of a white colour, 3 to 4 inches long, ½ to ¾ inch broad, and about 2-10th of an inch thick. Upper surface scaly, under surface marked by scars of numerous rootlets, a few of which sometimes remain attached; substance brittle and horny, yellowish white, central portion somewhat spongy, odourless. Taste at first insipid, but after a few minutes a sensation of warmth and pricking is felt upon the tongue.

Microscopic structure.—Sections show that the bulk of the rhizome consists of a parenchyme, each cell of which is occupied by a mass having a granular appearance inactive in polarized light; towards the circumference, the cells become gradually smaller, and upon the surface become scaly, forming a greyish epidermis. The cells are coloured black with

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iodine with purplish centres, such as starch and dextrin would exhibit. After immersion in glycerine and alcohol, the section showed no sphæroidal crystals of inulin, but ceased to give the purplish-black colour. The vascular bundles are of a bright yellow colour, and consist of spiral vessels; they form one irregular ring round the rhizome about midway between the circumference and centre.

Chemical composition.—A decoction of the powdered rhizome gave a blue or violet black colour with iodine, but was not affected by iron salts. Water extracted 15·6 per cent. of soluble substances, consisting of 6·2 per cent. of glucose, estimated by standard potassio-cupric tartrate, and a quantity of mucilage. The marc was then boiled for two hours with hydrochloric acid (1 per cent.), an operation which rendered soluble over 60 per cent. of the drug, while 25 parts of this was glucose. Some fresh powder yielded to rectified spirit 6·75 of extract, which, with the exception of a little fatty matter, was soluble in water. This solution was sweet to the taste, abundantly reduced Fehling's solution, and was negative towards alkaloidal tests. Evaporated to dryness it was amorphous, and when heated, gave off the odour of burnt sugar. The ash was 3·3 per cent. The analysis of the drug shows it to be nutritive rather than medicinally active.

TUSSILAGO FARFARA, *Linn.*

Fig.—*Eng. Bot. vi. t.* 429; *Woodville t.* 13. Colt's-foot (*Eng.*), Pas d'âne, Taconnet, Herbe de Saint Quirin (*Fr.*).

Hab.—Western Himalaya; Persia; Europe. The herb.

Vernacular.—Fanjiun (*Arab., Ind. Bazars*); Wátpán (*Hind.*).

History, Uses, &c.—This plant is the βήχιον of the Greeks and the Tussilago and Farfarus of the Romans. From the earliest times it has been esteemed useful in coughs and other pectoral affections. Hippocrates recommends the root with honey in ulcerations of the lungs. Dioscorides, Pliny, and Galen relate that the smoke of the leaves, received into the mouth

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through a funnel or reed, is efficacious in coughs and dyspepsia. The Greek and Linnean names are derived respectively from βήξ and tussis which both signify "cough." Most of the Arabian and Persian medical writers describe the herb under the name of Fanjiun, or Afanjiun, an Arab corruption of ἀπογέον, a word which, as far as we know, was never applied by the Greeks to any plant. All these writers closely follow Dioscorides in their accounts of its appearance and properties. The Hindus consider that the leaves have the power of expelling *vata* or wind, which is supposed to be the cause of various disorders, especially rheumatism; whence the name Vátapána or Watpan (wind-leaf); they also use the cotton-like down of the leaf as a styptic. In Europe, colt's-foot is still officinal in France and Germany, and has a reputation in pectoral affections as a domestic remedy in England. It is smoked like tobacco and also administered internally in the form of a decoction or infusion. The flowers are one of the *quatre fleurs* of French pharmacy.

Description.—Root mucilaginous, bitterish, creeping horizontally, with many fibres. Flowers coming before the leaves (whence the old name *Filius ante patrem*), drooping in the bud, bright yellow, about an inch broad; their rays spreading, copious, very narrow; each flower on a simple, round, woolly, radical stalk, scaly with numerous reddish, smooth, scattered bracts, crowded under the flower, like an exterior calyx. Leaves erect, on furrowed, channelled foot stalks, heart-shaped, slightly lobed, copiously and sharply toothed; very smooth, and of a slightly glaucous green above, white and densely cottony, with prominent veins beneath; when young they are revolute, and thickly enveloped in cottony down. (*Smith.*)

Chemical composition.—An analysis of the leaves of this plant has been made by C. S. Bondurant. A petroleum spirit extract contained caoutchouc, resin and wax. Ether removed a bitter, colourless glucoside, and a reddish brown resin. Absolute alcohol separated 2·42 per cent. of tannic matter, and probably a little gallic acid; the extract was free from alkaloids. Water dissolved from the residue 3·42 per cent. of

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gum, and 6·23 per cent. of dextrin and allied carbohydrates, and the alcoholic filtrate from these yielded 'saponin. Albuminous matter, oxalate of calcium, lignin and cellulose were determined, and the total ash was 17·1 per cent. (*Phar. Jour.* [3] xviii. 77.)

SAUSSUREA LAPPA, *Clarke.*

Fig.—*Dcne. in Jacq. Voy. Bot., t.* 104. Arabian Costus.

Hab.—Cashmere. The root.

Vernacular.—Kut (*Hind.*), Páchak (*Beng.*), Upalét (*Guz.*), Kushta (*Mar.*), Koshta (*Can.*), Goshtam (*Tam.*), Goshtamu (*Tel.*).

History, Uses, &c.—Sanskrit writers on Materia Medica mention a fabulous root under the name of Pushkaramula, "Lotus root," and ascribe to it properties similar to those of Costus. Among many other synonyms it bears the name Kashmira, "coming from Cashmere." We think there can be little doubt that this root, which is not now obtainable, and is described in the Nighantas as hot, bitter and pungent, and useful in cough, asthma, fever, dyspepsia and skin diseases, must have been Orris root. Kushta or Costus is now used instead of it, and orris root, although much used in India by the Mahometans, has not been identified by the modern Hindus with Pushkaramula. Κόστος* is mentioned by Theophrastus (H. P., ix. 7), Dioscorides (i. 15), and is among the offerings made, B.C. 243, by Seleucus II., King of Syria, and his brother, Antiochus Hierax, to the temple of Apollo at Miletus. Costus, like many other Indian drugs and spices, was formerly carried to Europe by the Arabs, and, being supposed to be a production of Arabia, was known to the ancients as Arabian Costus. Dioscorides says:—"The best is that which is fresh, light coloured, compact and of firm texture, dry, not worm-eaten, devoid of an acrid smell, and which tastes hot and biting." He also mentions an inferior kind, light like Ferula,

* The Greek name is derived from the Sanskrit कुष्ठ through the Arabic قسط

which he calls Indian Costus. The Syrian Costus of the same writer is Elecampane root. The Arabs appear to have had, like the Hindus, a fabulous kind of Costus, which they speak of as the carrot of the sea (جزر البحر) or Costus of the sea (قسط البحر), which is mentioned in a tradition as one of the best of remedies.

This myth probably led the Greeks to describe Arabian as distinct from Indian Costus. Arabian writers describe Costus as a wood brought from India, a well known drug, of sweet odour, with which women and infants are fumigated: it is diuretic, beneficial to the liver in a high degree, and for the colic, and for worms, and the quartan fever, as a beverage; and for rheum, and defluxions, and pestilence, when the patient is fumigated therewith; and for the leprous-like disorder called بهق, and the discoloration of the face termed كلف, when applied as a liniment; and it confines the bowels, expels wind, strengthens the stomach and heart, occasions pleasurable sensation, is an ingredient in many sorts of perfume, and is the best of perfumes in odour when one fumigates therewith (*El. Leyth*, "*Eyn*"; *Kámus; Taj-el-Arús*). Persian physicians copy all that the Greeks and Arabs have written, although they evidently know there is only one kind of Costus, and that brought from Cashmere. For an account of the history of this drug in mèdiæval Europe, Cooke (*Phar. Jour., July* 21*st*, 1877,) and Flückiger (*Phar. Jour., Aug.* 18*th*, 1877,) may be consulted. Amongst European writers upon the Materia Medica of India, Ainslie, although he describes Kust as the root of *Costus arabicus*, expresses his doubts in the following words: "Judging from the root, the plant would appear to differ from that described in the 11th Vol. of the *Asiatic Researches*, p. 349." The credit of first suggesting the botanical source of the drug is due to Guibourt; his conjectures were afterwards confirmed by Falconer, who, when on a visit to Cashmere, discovered that an *Aplotaxis* growing there produced the commercial Kust. The plant itself had been previously described by Jacquemont in 1831. Falconer's description may be found in the Transactions of the Linnean Society (1845, *Vol.* XIX., *p.* 23). There is also a full account of the drug and plant, with woodcuts, in

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Guibourt's History of Drugs (Vol III., 1869, p. 32, *et seq.*). Dr. Falconer maintained that the Aplotaxis was the Costus of the ancients; after giving his reasons for holding this opinion, he remarks:—

"It is collected in large quantities and exported to the Punjab, whence the larger portion goes down to Bombay, where it is shipped for the Red Sea, the Persian Gulf, and China; a portion of it finds its way across the Sutlej and Jumna into Hindustan Proper, whence it is taken to Calcutta, and bought up there with avidity, under the designation of Patchak, for the China market."

Royle, who wrote before Falconer's discovery of the source of Kust, appears to have met with two kinds of Costus, Kust-i-talkh and Kust-i-shírín; from his observations on the latter article it would seem to have been the Kust of commerce. (*Illustrations, p.* 360.) Dr. Royle's original specimen of Kust-i-talkh has also been examined and found to be the root of *Aplotaxis*. At the present day we meet with only one kind of Costus in commerce. Cooke suggests that Kust-i-shírín is probably the young and Kust-i-talkh the old root, but no distinction of the kind is known in Bombay, and Haji Zein-el-Attar, the author of the *Ikhtiárát* (A.D. 1368) states that Kust-i-talkh is a Persian name for Indian Costus. Kust-i-shírín is the Kust-el-halu of the Arabs and our Orris root.

With regard to the uses of Costus, Dr. Irving states that formerly, when opium was not produced in Rajwarra, this root was extensively smoked as a stimulant. He adds that it is said to be narcotic when thus used, and that formerly great quantities went to China for smoking purposes. At the present time it is chiefly used as a perfume, and to protect bales of cloth from insects. In the Punjab it is applied in powder to ulcers, for worms in wounds, &c., and for toothache; it is also given in rheumatism. A summary of the uses of this drug is given by Baden Powell in his *Punjab Products* in the following terms:—

"1*st*—Dried and powdered as the principal ingredient in an astringent stimulant ointment, applied to severe ulcerations.

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2nd—Dried and powdered as a hair wash.

3rd—As a stimulant in cholera; an infusion is made of Cardamoms 1 dr.; fresh 'Kut' 3 drs.; Water 4 ozs. One ounce every half hour. It is doubtless a powerful aromatic stimulant, and would be serviceable in any spasmodic disease.

4th —It is universally employed by the shawl merchants as a protector of Cashmere fabrics from the attacks of moth and other vermin.

5th—The dried root is an agreeable fumigatory, and yields excellent pastilles, which burn fairly.

6th—It is exported in enormous quantities to China, where it is used as an incense. In every Hong it is found; no mandarin will give an audience until the 'patchak' incense smokes before him; in every Joss-house it smoulders before the Tri-budh deity; in every floating junk in the Chinese rivers, the only house of countless hordes, Budh's image is found, and the smoke of the Patchak religiously wends its way heavenward. As to its uses in China, Dr. Porter Smith says that it is used in making incense in the South, or to preserve clothes from the attacks of moths and other insects. It is said to have the power of turning grey hair black. Carminative, stimulant, antiseptic, prophylactic, astringent, sedative, and insecticidal properties are referred to this remedy. The Chinese apply it with musk, which it resembles in odour and properties, to aching teeth."

Description.—Costus occurs in crooked twisted pieces about 3 inches long, and from ½ to 1½ inch in diameter, almost always split. Externally it is brown, marked by longitudinal ridges, and has a rough and somewhat reticulated surface. Its substance is compact and brittle, the fractured surface having a resinous appearance and dirty white colour. The central portion is generally absent, and appears to have been removed by decay before the root was collected. The taste is bitter, pungent and camphoraceous; the odour resembles that of fresh violets or orris root.

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Microscopic structure.—Flückiger in his pamphlet, "*Die Frankfurter Liste,*" Halle, 1873, p. 25, has shown that the root abounds in inulin, and shows, especially in the bark of the branches of the root, large balsam ducts. In both these respects Costus root agrees well with Elecampane and other aromatic roots of the Compositæ. A microscopic examination shows that the root consists of two parts, *viz.*, a thick cortical layer of close texture, pervaded by a few laticiferous ducts and an inner radiating portion, the parenchyma of which is not so dense. This is also provided with laticiferous ducts, and a very abundant scalariform vascular system, which appears to be loaded with resinous matter. We have not been able to detect any starch, nor does the iodine test indicate its presence.

Adulteration.—The natives of Cashmere say that this drug is apt to be adulterated with five or six other kinds of roots. A sample of false Costus in the Indian Museum, under the name of *Kút mitha*, examined by Cooke, was found to consist of pieces of a cylindrical root from 1 to 3 inches in length and from ½ to 1½ inch in thickness; externally it was nearly smooth, or longitudinally striate with transverse paler scars. It was much lighter and less compact than Costus, friable and farinaceous internally, very much subject to attacks from insects, with little or no apparent odour or taste, and containing a large quantity of starch, the granules of which were variable in size, and attached to each other in twos and threes. In 1859, a communication was made to the Agri-Horticultural Society of India of two roots, one called Kút and the other Thúth. They were from the hills of that part of the Kangra district which borders on Chumba. The "Kút" was identified as the "Costus," and the other was believed by Dr. Thompson to be the root of *Salvia lanata*, which was said to be common also in Cashmere, where it is used to adulterate "Kút." Subsequently Mr. H. Cope of Umritsar contributed some remarks to the same Society on the adulterations of this drug. "This adulteration," he says, "is now (1860) carried to such a pitch with the assistance not only of the tut (which so closely resembles the genuine article in every respect but its qualities, that

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it is difficult to distinguish the one from the other after admixture, which imparts to the false the odour of the true drug), but with other foreign substances of which cowdung is one, that I have ascertained as a fact that the more unscrupulous dealers use some 20 seers of the Kút to flavour 100 seers of trash. When tut was first found useful as an admixture, it was sold at Re. 1½ per maund; being now the main ingredient of the Patchak of commerce, it has risen to Rs. 4½. I am told that two other substances, resembling the genuine article in exterior appearance, have been ascertained to serve as ingredients in the mixture sent to Calcutta and Bombay for exportation to China under the name of Patchak. They are, a root called Chog, brought from the hills, which is generally reported to be a deleterious drug, and Nirbisí, the root of a species of Aconitum, probably a virulent poison." (*Cooke in Phar. Jour., July 21st, 1877.*) With regard to Mr. Cope's remarks, we may mention that there is no difficulty in obtaining genuine parcels of Costus in Bombay. Perhaps the adulterated article may be specially prepared for the China market.

Chemical composition.—The air-dried roots reduced to powder, after heating for 26 hours to 100°C., lost 13·70 per cent. in weight, and were practically free from odour. The ash amounted to 3·46 per cent., and contained manganese in marked amount.

The odorous principle of the drug appears to consist of two liquid resins, both soluble in ether, alcohol, and benzene. One is neutral in reaction, and possesses in a very marked degree the odour* of the drug: the taste is somewhat camphoraceous: it is liquid at ordinary temperatures, amber-coloured, and after standing for some time gives an indistinctly crystalline deposit. It is apparently unaltered by agitation with dilute caustic alkaline solutions; and may be distilled without any alteration in odour. With concentrated sulphuric acid it first affords a deep brownish yellow coloration, changing to rich carmine on standing. The other resin is also liquid, amber-coloured, and possesses a musty odour, and gives an indistinctly crystalline

* A mixture of musk and orris root.

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deposit on standing: the taste is pungent. It is also easily soluble in ether, alcohol, and benzene, and the alcoholic solution is strongly acid in reaction; with alkalies it combines, and on the addition of acids is precipitated as a milky white deposit. With concentrated sulphuric acid it affords a similar reaction to that of the first described resin.

In addition to these resins, evidence of an alkaloid was also obtained, together with traces of an ethereal salt of valeric acid, and an astringent principle giving a dark brownish coloration with ferric salts: and a dark solid resin soluble in amylic alcohol, but insoluble in ether or benzene.

Commerce.—The roots are dug up in the months of September and October, when the plant begins to be torpid; they are chopped up into pieces from 2 to 6 inches long, and exported without further preparation. The quantity collected is very large, amounting, as far as Dr. Falconer could learn, to 10,000 or 12,000 *khurwars* (load of 192 lbs.). The commodity is laden on bullocks, and exported to the Punjab, whence it finds its way to Bombay, and a portion to Calcutta through India. In Dr. Falconer's time the cost of collection and transport was about half a crown per cwt. Cleghorn states that it is also exported from Pangi on the Upper Chenab to the plains. The loads of it when passing, scent the air to some distance. Davies' "Trade Report" gives 20 maunds as exported to Afghanistan *via* the Bolan. Royle mentions that in one year (1837-38) 6,697 maunds of this root, valued at Rs. 99,000, were exported from Calcutta to China, and in 1867-68 nearly 10,000 maunds. In Cashmere the Maharaja is said to take it over from the collectors at half the price at which it sells again. In 1864, his income from this source was put down on good authority (according to Dr. Stewart) at 300,000 chilki, equal to nearly 1,90,000 rupees; but this, he adds, is scarcely credible.* Kút is imported into Leh in small quantities from Cashmere for exportation to Lhassa, where it is called, as well as by the

* In the last official Reports, the export of Chob-i-koot to the Punjab are valued at Rs. 16,000 only; but under the head of drugs, &c., there are exports valued at Rs. 1,00,000, part of which may possibly be Costus.

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Bhotes, *Rusta*, and is used for incense. In 1871, 33 maunds were imported into Leh from Cashmere, valued at Rs. 692. According to Dr. Falconer, at the time he wrote, the cost of collection and transport to a depôt at Cashmere was 2*s*. 4*d*. per cwt.: on entering India its value was enhanced to from 16*s*. 9*d*. to 23*s*. 9*d*. per cwt., whilst the commercial value at Canton was 47*s*. 5*d*. per cwt. From the Consular reports, it appears that in the year 1875 the imports of Costus into two Chinese ports only were for Hankow 1,270 piculs, valued at £5,224 6*s*. 3*d*, and Cheefoo 277 piculs, valued at £1,197, so that it is clearly no insignificant article of Chinese commerce. (*Cooke in Phar. Jour., July 21st*, 1877.) The value of Costus in Bombay averages Rs. 10 per maund of 37½ lbs.

CENTAUREA BEHEN, *Linn.*

Hab.— Persia, Syria, Armenia. The root.

Vernacular.—Sufed Bahman (*Pers., Indian Bazars*).

History, Uses, &c.—This root is the White Behen and white Rhapontic of European writers on Materia Medica and the Bahman abiad of the Arabians.

White and red Bahman were drugs of the ancient Persians, through whom the Arabs became acquainted with them, and introduced them into the West. From the Burhán-i-Kátia we learn that the word Bahman is equivalent to Brahman, and means the supreme intelligence; it is also the name of one of the Persian months, of the second day of each month, and of a plant which flowers in the month Bahman (January). Of this plant there are two varieties, red and white, the roots of which are fattening, expel flatulence, and are aphrodisiacal.

On the second day of the month Bahman, when the name of the day and month are the same, the Persians used to celebrate a feast, and cook all kinds of corn and meat, and sprinkle the flowers of the red and white Bahman upon the food; they also made a flour of the two roots and ate it with sugar, and the white Bahman they powdered and drank with milk to strengthen the memory. This day, which was called the *Bahmanjana*, was

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considered to be a propitious day for collecting medicinal herbs, commencing any undertaking, putting on new clothes, paring the nails, cutting the hair, &c.

Bahman-i-sufed is much used by Mahometan physicians, who consider it to be hot and dry in the second degree and a powerful aphrodisiac and resolvent of phlegmatic humours; they also prescribe it in calculous affections and jaundice. Ainslie (*Mat. Ind.* ii., 14) confounds it with Asgandh, the root of *Withania somnifera.* The dose is one dirhem. Red Bahman or Red Rhapontic, although a root of an entirely different structure, is always associated with white rhapontic in the East; its source is uncertain. The author of the *Makhzan-el-Adwiya* states that it is the root of a plant called by some Kaf-i-Adam.

Description.—*White Bahman.*—The dry root is of a whitish-brown externally, much shrivelled and twisted; near the crown it is marked by numerous circular lines. It may be either simple and tapering, or more or less branched; sometimes a portion of purplish stem remains attached; the average length is about 2½ inches, diameter ¾ of an inch; the interior is white and spongy; when soaked in water it swells and becomes mucilaginous. The taste is mucilaginous and slightly bitter. Microscopic examination shows a mass of regular parenchyma surrounded on the outside by the brown oblong cells of the cortex. The centre of each of the parenchymatous cells is occupied by a substance giving a transient blue-black colour with iodine. There are numerous bundles of spiral vessels.

Red Bahman is a tuberous root, consisting of a central portion about 2 inches in diameter, from which spring 5 or 6 tapering tubers from 1½ to 2 inches long, and from ½ to 1 inch in diameter at the base. At the top of the central tuber is a scaly crown about 1 inch in diameter. The external surface of the root is of a reddish-brown colour, scabrous and marked by numerous circular and longitudinal wrinkles; internally there is a dull red woody central portion, surrounded by a thick, yellowish-white horny layer, which near the crown becomes spongy. In the commercial article the root is sliced and the

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central woody part removed. A section of the lateral tubers shows a red woody core, from which radiate rows of red spots as far as the inner bark. The spots when magnified are seen to consist of bundles of scalariform vessels, surrounded by a collection of pigment cells; the medullary rays connect these bundles, and are composed of single rows of oblong cells filled with finely granular red pigment. The bulk of the tuber consists of transparent cells which contain no starch. The bark is composed of an outer layer of epidermal scales, a middle layer of tangentially extended cells loaded with red pigment, and an inner layer of closely-packed columns of cells containing finely granular matter, and sometimes red pigment. The root has a mucilaginous and somewhat astringent taste. In general appearance and minute structure it closely resembles that of the Pæony, and it is worthy of note that an edible Pæony (*P. albiflora*, Pall.,) is known to grow in Central Asia.*

Chemical composition.—The different nature of these two drugs is substantiated by comparing the results of their proximate analysis, and by their affording entirely different constituents.

	White Behen.	Red Behen.
Ether extract	1·6	0·6
Alcoholic „	4·6	9·9
Aqueous „	13·9	35·3
Organic residue	57·5	34·9
Moisture	16·2	12·1
Ash	4·6	5·9
Undetermined	1·6	1·3
	100·0	100·0

White Behen yields to ether a yellow oily liquid, imparting a persistent greasy stain to bibulous paper, soluble in rectified spirit with an acid reaction, crystalline on standing, and

* In the report from H. M.'s Consulate at Newchwang for 1884, it is stated by Dr. Morrison that in that year 13,733 lbs. of the root of this plant were exported from Manchuria for use as an astringent in blenorrhagia and the diseases of women.

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melting below 20°. It consists of free fatty acids. The alcoholic extract contains a sweet tasting, uncrystallizable sugar, not reducing Fehling's solution; the aqueous solution of this extract is not affected by ferric salts, tannin or alkaloidal reagents. After exhausting with alcohol, the residue, on being treated with water, swells up to a white mass like tragacanth, and mucilage and saccharine matter enter into solution. The mucilage is gelatinized by natural plumbic acetate.

Red Behen contains a small amount of white fat soluble in ether and benzol. Alcohol dissolves out a tannic acid, related to cinchotannic acid, and an alkaloid. The alkaloid is bitter, soluble in ether with an opal-blue fluorescence, and forms feathery crystals when evaporated from this solvent. It dissolves in sulphuric acid with a violet-blue fluorescence, which is destroyed by dilution with water and restored by alkalies. We propose the name *Bahmanine* for this new alkaloid. The aqueous extract is mawkish and sweet, containing 6·2 per cent. of glucose. With two volumes of alcohol no mucilage is precipitated, but with four volumes a pulverulent deposit similar to inulin or inuloid is produced. This was collected on a filter, dissolved in boiling water and inverted. The resulting sugar reduced Fehling's solution, and was right-handed towards polarized light.

VOLUTARELLA DIVARICATA, *Benth.*

Fig.—*Wight Ic. t.* 1139; *Bot. Mag. I.* 81, *t.* 4.

Hab.—Central, Western and Southern India. The herb.

Vernacular.—Bádáward (*Pers., Ind. Bazars*).

History, Uses, &c.—This drug is described by Mahometan physicians as the Shaukat-el-baida of the Arabs, the Lúfiniki of the Turks, and the Sanakhúrd of the Syrians. Other Persian names given for it are Kangar-i-sufed and Asfar-i-barí. It is generally described as a thorny plant, about two

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cubits high, with downy triangular stems as thick as the thumb or larger; heads of seed like those of a thistle, thorny and full of down; flowers purple, seeds like those of carthamus, but rounder. M. M. Husain says:—"Some have supposed this plant to be the same as the Shukai; this is not the case, but the two plants are nearly related. The true Bádáward has slender, white round stems, little more than a span high, slightly downy; flower heads white, surrounding them are three delicate soft spines like needles, so that all together they have much the appearance of a brooch, within is a quantity of white down, which, when the seeds are ripe, causes them to be carried about by the wind, hence the name *Bád-áward.* Medicinally the plant has tonic, aperient and deobstruent properties. It is said to drive away noxious reptiles when kept in the house." (*Makhzan, article Bádáward.*)

The Bádáward sold in India agrees with the description of Mir Mohammad Husain. *V. divaricata* is found on sandy ground in Guzerat, and is thus described in the *Bombay Flora*: "Stem flexuose, short, ramous; branches diffuse, procumbent, angularly striated, sub-glabrous, leaves shortly pubescent or sub-glabrous, those of the stem lyrate, of the branches sinuately pinnatifid, the lobes spinously mucronate, involucre ovate, scales ovate at the base, araneose, terminating in a prickle-like appendage, flowers purple, appear in the cold weather, common in light soils in Guzerat." The drug has a bitter taste; it is imported from Persia.

Chemical composition.—The powdered drug contains a green essential oil having the odour of southernwood. An acid resin and some fatty matter was dissolved out by ether. The alcoholic extract contained an organic acid coloured green with ferric chloride, but unaffected by gelatine. The aqueous solution of this extract was crystalline when evaporated, and gave indications of an alkaloid. The aqueous extract was highly coloured and contained gum. The evaporated filtrate from the gum after standing a few days showed some white crystalline tufts of a gritty substance of an organic nature which was not examined.

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Tricholepis glaberrima, *DC., Dcne in Jacq. Voy. Bot.* 98, *t.* 106, a plant of Central India, Marwar, the Concan and Deccan, *Vern.*—Bramhadandi, is believed by the natives to be a nervine tonic and aphrodisiac. It is a tall, erect, smooth plant, stem angled, leaves linear-lanceolate, acuminate, stem-clasping, distantly spotted with black specks, florets 7 lines long, heads of flowers small, terminal, purple.

CARTHAMUS TINCTORIUS, *Linn.*

Fig.—*Reich. Ic. Fl. Germ. t.* 746; *Bot. Reg. t.* 170; *Rumph. Amb. V.* 79. Safflower, Parrot seed (*Eng.*), Safran batard, Graine de perroquet (*Fr.*).

Hab.—Cultivated throughout India. (*C. oxycantha*, Bieb., is perhaps the wild form of this plant.) The flowers and seeds.

Vernacular.—Kar, Kusumba (*Hind., Guz.*), Kusum (*Beng.*), Kushumba (*Tam., Tel.*), Kusumbe (*Can.*), Kardi (*Mar.*).

History, Uses, &c.—This plant is the Kusumbha of Sanskrit writers, who describe the seeds as purgative, and mention a medicated oil which is prepared from the plant for external application in rheumatism and paralysis. It is the κνίκος of the Greeks,* who used the leaves like rennet to curdle milk in making cheese. Pliny (21, 53,) calls it Cnecos. Mahometan writers enumerate a great many diseases in which the seeds may be used as a laxative; they consider them to have the power of removing phlegmatic and adust humours from the system.

The author of the *Makhzan* states that Kurtum, Hab-el-asfar, and Bazr-el-ahris are the Arabic names for the seeds, and Khasakdanah and Tukm-i-kafshah the Persian. He also says that in Ghilan they are called *Tukm-i-kajrah* or *Tukm-i-kazirah*, in Syria *Káshni*, and in Turkey *Kantawáras*, and that the Greeks call them Atraktus (ἀτρακτυλίς), and Dioscorides Knikus (κνίκος). Ainslie has the following notice of the plant:—"A fixed oil is prepared from it which the Vytians use as an

* Theophr. H. P. vi., 1; Arist. H. A. v., 19; Dios. iv., 182.

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external application in rheumatic pains and paralytic affections also for bad ulcers; the small seeds are reckoned amongst their laxative medicines, for which purpose I see they are also used in Jamaica (the kernels beat into an emulsion with honeyed water). Barham tells us that a drachm of the dried flowers taken cures the jaundice." (*Mat. Ind. ii.*, 364.)

The seeds are known in England as Parrot seed. Under the name of safflower the flowers form an important export article to Europe; they contain two colouring matters, yellow and red, the latter is the most valuable. In silk dyeing it affords various shades of pink, rose, crimson and scarlet. Rouge is also made from it. According to Calvert (*Dyeing and Calico Printing, Ed.* 1878,) though the safflower has lost much of its value as a dye since the discovery of the aniline colours, it is still used extensively in Lancashire for the production of peculiar shades of pink of the Eastern markets. It is also used for dyeing red tape, and there is no more striking instance of "red-tapeism," than the love which is shown for this particular colour by the users of that article. Much cheaper pinks can be produced from aniline, but notwithstanding the attempts which have many times been made to introduce them, they have failed in every instance, because the exact shade has not been obtained.

Description.—The Carthamus grows about two or three feet high, with a stiff upright whitish stem, branching near the top; and has oval, spiny, sharp-pointed leaves, their bases half clasping the stem; the flowers grow in heads at the end of the branches, and are surrounded by numerous leafy bracts (involucre) in numerous rows, the outermost row being broad and spreading out flat, with their edges spiny, the middle ones more upright, of an oval form, and surmounted by an egg-shaped appendage with spiny edges, and the innermost much narrower, quite upright, with their edges entire, but terminated by a sharp spiny point. Each flower is perfect, and has an orange or yellow corolla longer than the involucre, their lower part, being imbedded in a dense mass of fringed scales and hairs

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but the chief characteristic consists in the absence of the bristles, technically termed pappus. The fruits are about the size of barley corns, somewhat 4-sided, white and shining like little shells. (*A. Smith, in Treasury of Botany.*)

Chemical composition.—The flowers of *Carthamus tinctorius* contain two coloured principles, one yellow, soluble in water, and of no use in dyeing; the other red, soluble in alkalis, and precipitable by acids from its alkaline solutions; this is *Carthamin.* To prepare it, safflower is first washed repeatedly with water, to free it from the yellow substance, then treated with solution of carbonate of sodium; the liquid is saturated with acetic acid, and pieces of cotton are immersed in it, on which the carthamin is deposited. After twenty-four hours the cotton is removed and treated with solution of carbonate of sodium, which redissolves the colouring matter; the solution is mixed with citric acid, whereby the carthamin is precipitated in red flocks, and, lastly, these flocks are dissolved in alcohol. The solution evaporated in vacuo yields the carthamin in the form of a powder, having a deep red colour with greenish iridescence.

It is sparingly soluble in water, insoluble in ether, but easily soluble in alcohol, yielding a fine purple solution.

According to Schlieper, carthamin has the formula $C^{14}H^{16}O^{7}$. M. Salvétat gives the following figures as representing the composition of safflower :—

Yellow colouring matter soluble in water...	26·1	to	36·0
Carthamin	0·3	to	0·6
Extractive matters............................	3·6	to	5·6
Albumen	1·5	to	8·0
Wax	0·6	to	1·5
Cellulose..	38·4	to	56·0
Silica	1·0	to	8·4
Alumina and oxide of iron	0·4	to	1·6
Manganese	0·1	to	0·5

A certain amount of pectic acid is also always stated to be present.

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The yellow colouring matter of Carthamus is acid. It has a bitter taste and great colouring power. It combines readily with oxygen, and is converted into a brown substance. It unites with oxide of lead, forming the compound $(Pb^2O)^5C^8H^{10}O^5$.

Commerce.—Kusumba is cultivated in most parts of India; it was formerly exported to the value of 6 to 7 lakhs of rupees yearly, but the present value of the exports is under one lakh.

The seed is of considerable importance as an oil seed in India. Value, Rs. 16 per candy of 8 pharrahs (about 5 cwts).

CICHORIUM INTYBUS, *Linn.*

Fig.—*Eng. Bot.* 539. Wild Succory, Chicory (*Eng.*), Barbe de Capucin, Chicorée (*Fr.*).

Hab.— Persia, Europe. Cultivated in India. The seeds.

Vernacular.—Kàsni (*Pers., Ind. Bazars*).

History, Uses, &c.—This plant has been in use as a potherb from a very early period; it was known to the ancient Egyptians, Greeks and Romans. Theophrastus (H. P. vii., 7, 8, 9,10, 11,) calls it κιχωρη and κιχωριον. Dioscorides mentions two kinds,—the wild, κιχωριον, and the cultivated, σερις; he describes both as astringent, cooling and stomachic, and states that the plant is also applied externally on account of its cooling properties in inflammatory affections. The Romans called the plant *Intubus* or *Intubum*, and the plural of the latter word has furnished the Arabs with their name *Hinduba.* Pliny calls the wild plant *Cichorium, Chreston* (useful), *Pancration* (all powerful), and *Ambubaia*; after enumerating its medicinal virtues, he says: "In addition to these qualities the Magi state that persons who rub themselves with the juice of the entire plant, with mixed oil, are sure to find more favour with others, and to obtain with greater facility anything they may desire." Endive seeds were sold in Rome under the names of *Erraticum* and *Ambubaia* or *Ambubeia,* and were supposed to be a panacea and to have the property of fixing the affections. The Syrian dancing girls, whom Cneius Manlius first brought to Rome (*Livy* 9,1), were

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also called Ambubaia (endive seed), on account of their attractive allurements, just as such persons are often addressed in India as Eláchi-dána (cardamom seeds) for the same reason. Ambubaia is a Syrian term, but the component parts of it Ambui (انبوی) odour, and Baia (بیا) full, occur in old Persian. It signifies full of odours, *i.e.*, allurements. The wild endive is the Tarkashkun of the Persians and of Ibn Sina. Aitchison found it common every where in Khorasan, and also cultivated in gardens as a pot-herb under the name of Kásni. We have sown the seed sold in the Indian bazars, and have obtained a semi-cultivated form of the plant with upright leaves. The same form is cultivated by Mahometans at Hyderabad in the Deccan. The Germans call the wild Endive Wegewarte, "road guardian;" Wegeleuchte "road light;" Sonnenwende or Sonnenwirbel, "solstice;" Sonnenkraut, "sun herb;" and Verfluchte jüngfer, "unhappy young girl." According to the legend (*Klytia, Berlin*, 1875,) the plant is supposed to have been once a beautiful princess who, having been deserted by (or lost) her husband (or lover), was at her own request changed into this plant. A full account of the forms which this myth takes in Austrian Silicia, Bavaria and the Tyrol, quoted from Mannhardt, will be found in De Gubernatis (*Myth. des Plant.*, ii, 87), where he compares these legends with those concerning the Basil and Indian Tulasi. Endive is much valued by the Indian hakims as a resolvent and cooling medicine, and is prescribed in bilious complaints much as Taraxacum is in Europe. The seeds are one of the four lesser cold seeds, and, as such, are still much used in the East.

Chicory root dried, roasted and reduced to powder, is very extensively used in Europe as a substitute for coffee and for adulterating that article. Stillé and Maisch state that from 3,500,000 to 4,000,000 lbs. are annually imported into the United States from Europe. The European consumption is probably not less than 20,000,000 lbs.

Description.—The achenes are about the same size as those of the lettuce, angled, of a pale, mottled grey colour.

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The root is fleshy and tapering, somewhat branched, longitudinally wrinkled, light brown externally and whitish internally. The bark is rather thin, radially striate from the dark coloured milk-vessels, and separated by a brown cambium-line from the finely porous yellow wood. The taste is bitter and mucilaginous.

Chemical composition.—Nietzki (*Archiv. d. Pharm.* (3) 8, 327) has separated from the flowers a crystalline colourless glucoside, $C^{32}H^{24}O^{19}$ 4½ aq. insoluble in ether, freely soluble in hot water and alcohol, and dissolving with a yellow colour in alkalies. Boiling dilute acids split it up into glucose and $C^{20}H^{14}O^{9}$, which also occurs in the flowers. This forms needles very slightly soluble in boiling water, and coloured dark green by ferric chloride. According to Dragendorff the cultivated root contains 36 per cent. of inulin. The seeds contain a bland oil. According to König the following figures represent the composition of fresh and dried and burnt chicory :—

	Fresh.	Dry.
Water	75·69	12·16
Nitrogenous matter	1·01	6·09
Fat	·49	2·05
Sugar	3·44	15·87
Nitrogen free extractive.	17·62	46·71
Cellulose	·97	11·00
Ash	·78	6·12

LACTUCA SCARIOLA, *Linn.* var. *sativa.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 1421. Garden Lettuce (*Eng.*), Laitue cultivée (*Fr.*).

Hab.—Cultivated throughout Persia and India. The seeds.

Vernacular.—Káhu (*Pers., Ind. Bazars.*)

History, Uses, &c.—Lettuces have always been greatly esteemed on account of their cooling and refreshing properties.

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In the wild state they produce to a certain extent narcotic and sedative effects, but these appear to be almost entirely removed by cultivation; still, even in the cultivated varieties, a milky and bitter juice exists in the flower stem. Lettuces θρίδαξ* appear to have been used for salads at a very early period. According to Herodotus, they were served at the tables of the Persian kings more than 400 years before the Christian era. The opium of Galen is supposed to have been Lettuce opium. The Greeks and Romans considered the lettuce unlucky, and used it only at funerals as a food.

Apuleius (*De Vir. Herb.*) speaks of it as a valuable medicinal herb—

"Herbæ lactucæ sylvaticæ succum cum vino optimo vetere et melle acapno quod sine fume collectum est, mixtum in ampullam vitream condito, et eo utaris, summam medicinam experieris." The seeds are one of the four lesser cold seeds of old writers, and as such still retain their position in the Materia Medica of the East. Mir Muhammad Hussain in his *Makhzan* mentions several kinds of lettuce, and also lettuce opium; but he acknowledges the superiority of the lettuces raised from English seed in India over those of Persia, and enlarges upon the cooling and purifying action of the herb upon the blood. The lettuce seed of the bazars is white: it is imported from Persia, and is sold for Re. ¼ per lb.

The Arabic name is *Bazr-el-khas* and the Persian *Tukm-i-káhú*. Both plant and seed are too well known to require description.

Chemical composition.— Lactucarium is a brown viscid substance obtained by evaporating the juice, which exudes when the stems of the wild lettuce are wounded. It has a peculiar opium odour and acts as a narcotic. German lactucarium contains, according to Ludwig, from 44·4 to 53·5 per cent. of *lactucone*; a soft resin; about 4 per cent. of an easily fusible waxy body; *lactucin*, the chief active principle of the substance;

*Also θριδακίνη, Theoph. H. P. I., 16, 19, vii, 1 to 5. The wild lettuce, θρ. αγρια, vii., 6.

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lactucic acid; about 1 per cent of oxalic acid; a non-volatile not bitter acid which reduces oxide of silver; and a volatile acid smelling like valerianic acid, both in small quantity only; about 7 per cent. of albumin; at least 2 per cent. of mannite; a small quantity of a neutral, not bitter, unfermentable substance, crystallising in rhomboid pyramids; and from 3 to 6 per cent. of ash, containing potash, soda, manganic oxide, ferric oxide, and a small quantity of lime. Lactucin is yellowish, fusible, bitter, soluble in 80 parts of cold water, moderately soluble in alcohol and in acetic acid, less soluble in ether which deposits it on evaporation in nacreous scales or rhombic tables. Formula according to Walz, $C^{40}H^{48}O^{13}$. The leaves of the cultivated lettuce were found by Church to contain water 95·98 per cent.; albuminous matter 0·71; starch, sugar and gum 1·68; cellulose and lignose 0·52; chlorophyll and fat 0·22; ash 0·89. The ash was very rich in nitrates.

König gives the following as the mean composition of the garden lettuce:—

Water	94·33
Nitrogenous matter	1·41
Fat	·31
Non-nitrogenous extractive	2·19
Cellulose	·73
Ash	1·03

TARAXACUM OFFICINALE, *Wigg.*

Fig.—*Reich. Ic. Fl. Germ. xix. tt.* 1404—1406; *Woodville, t.* 16; *Bentl. and Trim. t.* 159. Dandelion (*Eng.*), Pissenlit (*Fr.*)

Hab.—Throughout the Himalaya and the Nilgiris. Cultivated in N.-W. Provinces. The root.

Vernacular.—Dudhal, Baran, Kánphúl (*Hind.*).

History, Uses, &c.—The derivation of the mediæval name Taraxacum is uncertain, but it seems not improbable that it was a corruption of the Persian طرخشقون (Tarkhashkún), the name of a kind of wild endive mentioned by Ibn

Sina, which he describes as useful in dropsy and obstructions of the liver. The same plant is noticed by other Arabian and Persian writers, all of whom describe it as the wild endive, and some of whom add that it has bluish flowers.

The Greeks and Romans speak of several varieties of endive, but there is nothing in their descriptions to lead us to suppose that they were acquainted with our Taraxacum. Fuchsius (1542) figured *T. officinale* (*Ic.* 391, *f*), and named it *Hedypnois*, a name given by Pliny (20, 31) to one of his kinds of wild endive. Tragus (1552) figured it under the name of *Hieracium majus*. Matthiolus (1583) called it *Dens leonis*, and Linnæus (1762) *Leontodon Taraxacum*, on the supposition, apparently, that it was the Tarkhashkún of Ibn Sina. At the close of the last century dandelion began to be much used as a remedy for chronic obstructions of the liver and bowels, and as a diuretic in calculous affections. From experiments made by Rutherford and Vignal, it appears that taraxacum is but a feeble hepatic stimulant, but it has powerful diuretic properties. Taraxacum is very popular in India in cases of hepatic congestion due to, or associated with, atonic dyspepsia and constipation; indeed, it has become quite a domestic remedy in this country. It is cultivated as an annual crop at Saharanpur for the use of the Government sanitary establishments. The Madras Medical Stores are supplied with the root from the Nilgiris.

Description.— The perennial root is from 6 to 12 or 16 inches long, nearly cylindrical, ½ to 1 inch thick, crowned with several short thickish heads above and furnished with few branches below. Fresh, it is light yellowish-brown and fleshy; when dry, dark brown or blackish-brown, much wrinkled longitudinally; internally, it is white with a yellowish centre. It is inodorous and has a bitter taste. It is hygroscopic, and in damp weather rather flexible, but when dry breaks with a short fracture, showing the pale yellow porous wood surrounded by a dark brown cambium-line and a thick white bark, with concentric circles of milk-vessels of a brownish colour, and

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separated by layers of thin-walled and axially elongated parenchyma. The meditullium has no medullary rays, and consists mainly of ducts varying in diameter and more or less interspersed with thin-walled, elongated cells.

After frost and early in the spring the root is sweet; during the spring and summer the milk-juice becomes thicker and the bitter taste increases; the root is, therefore, directed to be collected late in the autumn. The spring root yields a bitterish-sweet extract. Bentley regards the root collected about July as most efficient. (*Stillé and Maisch.*) The annual root as cultivated in India is very much smaller.

Chemical composition.—The bitter principle, *Taraxacin*, was obtained by Polex (1839) in a crystalline state by treating the milk-juice with boiling water and evaporating. Kromayer (1864) found it necessary to leave the aqueous solution in contact with animal charcoal, from which afterwards alcohol dissolved the bitter principle, requiring treatment with lead acetate and sulphuretted hydrogen to free it from colouring matter and other principles. Kromayer obtained taraxacin as an amorphous bitter mass. The milk-juice contains also *resin* and *taraxacerin*, $C^8H^{16}O$, which is insoluble in water, crystallizes from hot alcohol, and when in an alcoholic solution has an acrid taste. The dry root yields from 5 to 7 per cent. of ash.

Dandelion root collected in autumn is rich in inulin. Dragendorff (1870) obtained from the root collected in October 24 per cent. of inulin and a little sugar, but when collected in March only 1·74 per cent. of inulin was found, and about 18 per cent. each of uncrystallizable sugar and *levulin*, the latter being intermediate between inulin and sugar in having the composition of inulin, but being of a sweet taste, soluble in cold water, and without influence on polarized light. Frickhinger (1840), Widemann, and others had obtained notable quantities of *mannit* from the concentrated juice of dandelion, but T. and H. Smith (1849) proved that this principle does not pre-exist, and that, on the contrary, it is a product resulting from fermentation.

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The presence of fermentable sugar has been observed by most investigators, and Dragendorff's observations confirm the results previously obtained by Frickhinger, Widemann, and Overbrook, that the sugar predominates in the spring root, and inulin in the root collected in autumn. It seems to follow therefrom that the extract and other preparations made from the expressed juice or by treating the autumn root with cold water should be more efficacious and less loaded with inert matters (sugar, &c.) than those obtained from the spring root. Old extract of taraxacum sometimes contains granular crystals of calcium lactate (Ludwig, 1861); the lactic acid is probably produced from *inosit*, which, according to Marmé (1864), exists in the leaves and stalks of dandelion, but is not found in the root. (*Stillé and Maisch.*) The fresh plant, which is used in Europe as a salad, has been analysed by H. Storer and S. Lewis, who found it to consist of Water 85·54, Nitrogenous substances 2·81, Fat 0·69, Non-nitrogenous extractive 7·45, Cellulose 1·52, Ash 1·90. In the dried plant they found Nitrogen 3·11, Carbohydrates 51·52 per cent. (*König, Nahrungs Mittel.*)

Substitutes for Taraxacum.

Launæa pinnatifida, *Cass.*, *Wight Ill.*, *t.* 133, a native of the sandy coasts of India, is much used at Goa as a substitute for Taraxacum under the name of *Almirao.* The plant has a filiform, procumbent stem bearing roots and leaves here and there; leaves crowded, sinuate-pinnatifid, lobes obtuse or subacute; peduncles rather shorter than the leaf, having at the top scaly bracts which are scarious on the margin. The roots are fleshy, about the size of a crowquill, and 6 to 8 inches long; when fresh they are yellowish-white. A section shows a yellow central fibro-vascular column, containing very large fenestrated vessels arranged in a radiating manner Beyond the radii the parenchyma is loaded with large colourless bodies of irregular size and shape, which gradually diminish in number towards the cortex, where the parenchyma is not

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occupied by them The cellular structure is delicate and the cells large. These bodies appear to be cells distended by some solid nearly transparent matter (inulin ?) as they correspond in form and position with neighbouring empty cells. In Bombay under the name of *Pathri* it is given to buffaloes to promote the secretion of milk. Murray refers the Ban-káhú of Sind to this plant, but his description agrees better with that of *Launæa nudicaulis*, Less. He says the juice of the Ban-káhú, called *Khee-khowa*, is used as a soporific for children in doses of half a massa, and is externally applied in rheumatic affections combined with the oil of *Pongamia glabra* or the juice of the leaves of *Vitex leucoxylon.*

Lactuca Heyneana, *DC., Wight Ic., t.* 1146, is also used as a substitute for Taraxacum, and is called by the Portuguese *Taraxaco.*

Emilia sonchifolia, *DC., Rheede Hort. Mal. x. t.* 68, appears to be used all over India much in the same manner as Taraxacum. Rumphius figures it, and says that the Portuguese call it Erva de Figado, *i.e.*, hepatis herba. It is the Muelschevi of Rheede, who says—" Decoctum antifebrile est et asthmaticum, succus ventris sedat fluctus cum saccharo assumptus. Contrita cum butyro apostemata maturat et aperit."

E. sonchifolia is the *Sadamandi* of Western India, the *Shudimudi* of Bengal, the *Kadoo-para* of Ceylon, where it is used as a sudorific, and we have received it from Cawnpore under the name of *Hiran-khuri.* It is a very common weed of cultivation, and may be found in every Indian garden.

Sonchus oleraceus, *Linn., Wight Ic. t.* 1141, the Milk Thistle of the English and Laiteron of the French, is used in decoction as a laxative and emollient drink in chronic affections of the digestive organs. Dr. F. Landry (*Med. Bullet.*—1888) has pointed out that the inspissated juice, given internally in doses of 12 to 25 centigrams, is an active hydrogogue cathartic acting on the liver, duodenum and colon. Like elaterium, it produces copious watery stools, and would appear likely to be useful in ascites and hydrothorax. Its administration

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requires watching, as like senna it causes griping and like aloes tenesmus. Dr. Landry suggests its combination with manna, anise and carbonate of magnesia; or with stimulants and aromatics. (*Pharm. Journ.*, *Sept* 1888.) This weed is common in many parts of India in fields and cultivated places.

Some plants of minor importance used medicinally and belonging to this Order are:—

Echinops echinatus, *DC.*, the Utáti of Sanskrit writers and the Utkatára of the bazars. It is a thistle-like plant 1 to 2 feet high, with pinnatifid spinous leaves, the under surface of which is cottony. The flower heads are about 1 inch in diameter and armed with many stout spines. The root is tapering and of a whitish brown colour. The drug is considered to be tonic and diuretic. It is bitter and appears to us to have much the same properties as the *Carduus benedictus* of Europe.

Dicoma tomentosa, *Cass.*, *Wight Ic.*, *t.* 1140. *Vern.*—Navananji-cha-pála (*Belgaum*). An erect much-branched annual, 10 to 18 inches high, clothed with white cottony wool; leaves sessile linear or linear-obovate, obtuse or acute, quite entire, cottony, 1 to 3 inches long; heads sub-axillary, involucre bracts, ½ to ¾ in., subulate, spinescent, straight, glabrous, shining; achenes broad and short, ⅛ in. long, turbinate, densely silky; pappus shining, elastic, brush-like. The herb is strongly bitter, and is used in the neighbourhood of Belgaum as a febrifuge, especially in the febrile attacks to which women are subject after childbirth. Dr. Peters, of the Bombay Medical Service, first brought to notice the use of this plant medicinally by the natives.

Notonia grandiflora, *DC.*, *Deless. Ic. Sel. iv.*, *t.* 61; *Wight Ic. t.* 484. *Syn.*—Cacalia Kleinia, Herb. Madras. The *Wándar-roti* of the Mahrattas, was named by DeCandolle after Mr. Benjamin Noton of Bombay, who first met with it on the Nilgiris; it is also found upon high rocky precipices in the Deccan. In 1860, Dr. A. Gibson brought forward this plant as a preventive of hydrophobia. The mode of admin-

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stration is as follows: about four ounces of the freshly gathered stems, infused in a pint of cold water for a night, yield in the morning, when pressed, a quantity of viscid greenish juice, which being mixed with the water, is taken at a draught. In the evening a further quantity of the juice, made up into boluses with flour, is taken. These medicines are directed to be repeated for three successive days. The Editor of the *Pharmacopœia of India* says that from official documents placed at his disposal, it appears that the remedy has been tried in numerous cases; but as at the time of the infliction of the wound, caustic was applied locally in the majority of cases, it is difficult to determine how far the Notonia operated, if at all, as a prophylactic. (*Phar. of India, p.* 126.)

An extract of the herb was tried by the late Dr. Haines and one of us on dogs, and afterwards at the European Hospital in Bombay (1864). In one drachm doses it had a feebly aperient action; no other effect was observed. The dried plant was for a time issued to medical officers in Government employ, but no further information as to its properties would appear to have been obtained. *N. grandiflora* is a shrub, fleshy, smooth; stem thick, round, marked with the scars of fallen leaves; leaves oblong or ovate, entire; flowers terminal, corymbose, few, pale yellow. The dry stems, which are white, soft and fragile, yield an abundant greenish extract.

Tagetes erecta, *Linn. Bot. Mag. t.* 150. French Marigold (*Eng.*), Œillet d'Inde, Rose d' Inde (*Fr.*), Makhmal, Gul-jáferi (*Hind.*), Rojia cha phúl (*Mar.*), is quite naturalized in India. One tola of the juice of the petals heated with an equal quantity of melted butter is given daily for three days as a remedy for bleeding piles; they are considered to have a purifying action upon the blood. The flowers of this plant are much used for making garlands to hang over doorways on festive occasions. Rojia (rose), the name current on the Western Coast, was probably introduced with the plant by the Portuguese, with whom it appears to represent the *Rosa de ouro* or golden rose, which the Pope usually blesses at mass on a Sunday in Lent.

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Anaphalis neelgerriana, *DC., Prodr.* vi. 272, and other species are used on the Nilgiris for cut wounds. The leaves are covered with woolly down, and are called by the natives *Kaat-plaster* or country plaster. The fresh leaves are bruised and applied to the wound under a rag.

The flowers of **Carduus nutans,** *Linn. Reich. Ic. Fl. Germ. t.* 146, *Vern.*—Kanchari, are employed as a febrifuge in Sind and in the Punjab.

Calendula officinalis, *Linn.* The pot Marigold (*Eng.*), Souci des jardins (*Fr.*), *Bot. Mag. t.* 3204, a native of the Mediterranean Coasts, formerly esteemed as a domestic remedy, is found as a weed of cultivation in Northern India.

CAMPANULACEÆ

LOBELIA NICOTIANÆFOLIA, *Heyne.*

Fig.—*Wight Ill.*, t. 135. Wild Tobacco (*Eng*).

Hab.—Bombay to Travancore, Ceylon. The plant.

Vernacular.—Dhavala (*Mar.*), Kattu popillay (*Tam.*), Adavi-pogaku (*Tel.*), Kadahogesappu (*Can.*).

History, Uses, &c.—This Lobelia was first described by Heyne, who found it near Bangalore. We have met with no mention of the plant in native medical works, but the Marathi name appears to be of Sanskrit origin and to signify "white," probably in allusion to the colour of the flowers. Graham (*Bombay Plants*) states that the dried stalks, which are hollow in the centre, are sold in the bazar at Mahableshwar, and used as Koluri horns for collecting herds of cattle and scaring wolves. In the Concan a kind of rustic pipe called पांवा (páṇvá) is made from them. In the *Pharmacopœia of India* an infusion of the leaves is said to be used as an antispasmodic. The dry herb when handled is extremely acrid, the dust irritating the throat and nostrils. It is called wild tobacco among the Tamils

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and is regarded by the natives as poisonous wherever the plant grows. Physiological experiments conducted by Herr von Rosen at Dorpat have shown that this plant has properties exactly similar to those of *Lobelia inflata*. The physiological action of poisonous doses of lobelia upon the carnivora and upon man is to cause death by paralysing the respiratory centre. Small doses first raise and then depress the blood pressure; large doses paralyse the vasomotor centre and the peripheral ends of the vagi. (*Attwood.*) The effects produced by lobelia on man have been carefully studied by Barallier of Toulon, who found that after taking an infusion of 1 grain of the leaves in 400 grains of water, he felt a burning and rawness in the fauces, headache, and a sensation of constriction beneath the sternum; his pulse became weak, slow and intermittent, and there was diuresis. Larger doses produced general muscular weakness, vomiting, difficult breathing, cardiac depression, reduction of temperature and dilatation of the pupils. The action of lobelia is therefore similar to that of tobacco and its alkaloid nicotine. (*Barallier, Des effets physiol., &c., de la Lobelia inflata. Bull. de Thérap.*, lxvi.)

The chief medicinal value of lobelia is in the treatment of asthma, whether the disease be purely spasmodic or associated with pulmonary emphysema, chronic bronchitis, heart disease, &c. It eliminates from the attack the bronchial spasm, which in the first-named affection constitutes the whole disease, and in the others is a complication only. A fluid drachm of the tincture should be given every hour, or, if the symptoms are urgent, every half hour, until relief is obtained, or the characteristic effects of the medicine are produced. Its efficacy in other diseases, as in whooping cough, will depend mainly upon the predominance of the nervous element in them. Whenever dyspnœa is due to inflammatory changes in the bronchia, or to the presence in these tubes of secreted matters, rather than to spasm, lobelia displays special virtues that entitle it to be preferred before numerous "expectorants." It is of no more advantage in inflammatory laryngitis than various other nauseants and emetics, but it is decidedly more effica-

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cious in spasmodic laryngitis than most other remedies of the same class. In almost all cases in which distress in breathing arises from a want of proper balance between the lungs and the heart, this medicine affords relief; as, for instance, when the lungs are congested by mitral obstruction and there is a tendency to œdema of those organs; and, again, when the lungs are themselves diseased so as to interfere with the cardiac circulation, as occasionally happens even in tuberculous consumption. (*Stillé and Maisch.*)

Description.—The leaves resemble those of the tobacco; they are finely serrated and covered with simple hairs. The lower part of the stem is woody, an inch and a half or more in diameter, and almost solid; the upper portion is a hollow tube ending in a crowded head of flower spikes; the latter are about a foot in length, and when the plant is in fruit, are thickly set with globular capsules about the size of a pea, to which a portion of the dry flower is often adherent; the capsules are two-celled, each cell containing a fleshy placenta. The seeds are numerous and very small (1-50th of an inch in length), oval, flattened, of a light brown colour, and marked with delicate lines. Several small tubercles surround the site of the placental attachment.

The whole plant when dry is studded with small spots of resinous exudation, and is hot and acrid to the taste. The leaves and aerial parts of the fresh plant exude a white latex when broken.

Chemical composition.—Herr von Rosen's examination of the plant, supplied by one of us, showed it to contain two alkaloids; this led to a re-examination of *Lobelia inflata*, with the result that two similar alkaloids were found to be present in the latter plant. The discovery of von Rosen has been confirmed by J. U. and C. G. Lloyd (*Pharm. Rundschau*, 1887), but they describe the alkaloids somewhat differently; one, for which they appropriate the name *Lobeline*, was obtained as a colourless and odourless amorphous substance, non-hygroscopic, and apparently not affected by air; slightly soluble in water, and

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readily soluble in alcohol, chloroform, ether, benzol and carbon bisulphide. Its salts are most powerful emetics, producing emesis without disagreeable after symptoms.

The other alkaloid *Inflatine* was obtained in large colourless, odourless and tasteless crystals, insoluble in water or glycerine, but soluble in carbon bisulphide, benzol, chloroform, ether and alcohol.

Therapeutically inflatine has no apparent importance. In spite of the statements of previous workers, no volatile or liquid base was met with by the authors, and it would seem probable that the supposed liquid alkaloid previously observed was a mixture of lobeline, inflatine and oil.

ERICACEÆ.

GAULTHERIA FRAGRANTISSIMA, *Wall.*

Fig.—*Wall. in As. Research.* xiii., 397; *Wight. Ic. tt.* 1195—96; *Bot. Mag.* 1984. Indian Wintergreen (*Eng.*).

Hab.—Hills of India, Burma and Ceylon. The essential oil.

Vernacular.—Gandapuro (*Jav.*).

History, Uses, &c.—This ramous shrub with thick coriaceous leaves, white flowers and blue berries, inhabits the grassy hills and affords an essential oil nearly identical with that of *Gaultheria procumbens* (*Canadian Winter Green*). Mr. Broughton, the late Government Quinologist at the Nilgiris, in a report to the Madras Government on the subject of this oil, says:—"The oil from this source contains less of the peculiar hydrocarbon which forms a natural and considerable admixture with the Canadian oil, and therefore is somewhat superior in quality to the latter. The commercial demand for the oil is not, however, considerable enough to make its occurrence in India of much direct importance.

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"It occurred to me in 1869 that methyl-salicylic acid would, however, under suitable treatment, furnish carbolic acid according to a decomposition described by Gerhardt. After a few experiments I was successful in preparing considerable quantities of pure carbolic acid. The method of manufacture is as follows: —The oil is heated with a dilute solution of caustic alkali, by which means it is saponified and dissolved, methylic alcohol of great purity being liberated. The solution of the oil is then decomposed by any mineral acid, when beautiful crystals of salicylic acid are formed. These are gathered, squeezed, and dried. They are then mixed with common quicklime or sand, and distilled in an iron retort; carbolic acid of great purity, and crystallizing with the greatest readiness, passes into the receiver. This acid is equal to the purest kind obtained from coal tar, and employed in medicine. It, of course, possesses all the qualities which have rendered this substance almost indispensable in modern medical and surgical practice. (*Pharm. Journ., Oct.* 1871.)

The shrub has no vernacular name on the Nilgiris, and does not appear to be used by the natives except the berries which are eaten by the Badagas. The *Gandapuro* of Java (Ainslie, *Mat. Ind.* ii. 106) is referred to an Andromeda, and it is interesting to notice that on the authority of Dr. Horsfield, the volatile oil was used by the natives in rheumatic affections. Dr. de Vrij obtained a considerable quantity of oil from the leaves of two Javanese species, *G. leucocarpa* and *G. punctata*, and this was found by Köhler to be identical with Canadian Wintergreen oil.

Wintergreen oil is used as a flavouring agent on account of its agreeable odour. It is a convenient antiseptic, a drop or two of the oil will preserve a bottle-full of gum or of ink from mould for several months, and it is a useful adjunct to hypodermic injections and other pharmaceutical preparations. In large doses it produces the same effect as other aromatic essential oils. The large proportion of methyl salicylate contained in the oil naturally led to its employment in rheumat-

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ism. It was apparently first used for this purpose by Mr. Casamayor of Brooklyn, N. Y. (*Ephemeris*, i. 30), and next by Dr. Kinnicutt of New York (*Med. Record*, xxii. 505). Twelve cases of acute articular rheumatism treated by the latter gave an average duration of the pyrexia of 3½ days; of the joint pains, 4½ days; of the stay in hospital, 24½ days. The oil was given at first in doses of 10 minims every two hours until eight doses had been taken, and afterwards the doses were increased as well as their frequency. The reporter believes that his cases presented less than the usual proportion of heart-complications; but if so, the oil must differ in its effects from its active element, salicylic acid. Dr. Austin Flint (*Phila. Med. Times*, xiii., 846,) and Dr. Gottheil (*Med. Record*, xxiv., 258,) have reported analogous results. Dr. Waring (*Brit. Med. Journ.*, June 6th, 1885) suggests the Indian oil for use as a stimulant, carminative and antiseptic.

Dr. Charteris, after experimenting on the comparative action of natural and artificial salicylic acid, concludes that the restlessness, confusion, delirium and retarded convalescence attendant on the use of the acid and its sodium salt in acute rheumatism is due to the impurities of the acid prepared from coal-tar, and that natural salicylic acid and its salts are much safer remedies (*Brit. Med. Journ.*, Nov. 1889).

Description.—Oil of gaultheria is usually of a reddish colour, but may be obtained colourless by rectification. According to I. E. Leonard (1884), the colour is usually due to the presence of a little iron, and is readily removed by citric acid. It has a strong and agreeable aromatic odour and a sweetish, warm, aromatic taste, and begins to boil at a little above 200° C. Its specific gravity is 1·180 at 15° C. Occasionally, oil of gaultheria is lighter (1·170), in consequence of containing a light hydrocarbon, but the extent of this variation has not been fully determined. The oil is neutral or faintly acid to test-paper; has a slight dextrogyre rotation, and dissolves readily in alcohol and but to a small degree in water; the solutions acquire a dark-purple colour on the addition of ferric chloride. The pure-oil is not coloured on the addition of

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strong nitric acid, but soon congeals into colourless crystals of a nitro-compound. A solid crystalline mass is also obtained on agitating the oil with concentrated solution of potassa or soda. (*Stillé and Maisch.*) The Nilgiri oil has a sp. gr. of 1·087 at 15·5, and has no action on polarized light.

Chemical composition.—Procter (1842) recognized the presence in this oil of salicylic acid. Cahours subsequently (1843) proved it to consist to the amount of about 90 per cent. of methylsalicylic acid (methyl salicylate or mono-methylsalicylic ether), $CH^3C^7H^5O^3$. 100 grains of the oil contains 81 grains of salicylic acid. Pure methyl salicylate is a colourless oil, has the specific gravity of 1·18, boils at 222° C. (Cahours), and forms crystalline compounds with the alkalies. The remaining constituent of oil of wintergreen—of which Pettigrew (1884) obtained only 0·3 per cent.—is *gaultherilene*, a colourless thin hydrocarbon of the formula $C^{10}H^{16}$, boiling at 160° C., and having a strong peculiar odour, described as pepper-like by Cahours. Trimble and Schrœter determined the hydrocarbon to be a sesquiterpene of the formula $C^{15}H^{24}$, and obtained crystals similar to benzoic acid from the oil.

Commerce.—The leaves yield more oil in the fine weather, from January to April, than at other times of the year; but owing to the sluggishness with which it comes over in the still, it could not be sold for much less than Rs. 6 per pound. The preparation of carbolic acid from the oil to compete with that from coal tar is out of the question at the present time but it might, with advantage, be used in making salicylic acid reducing the price of the natural acid which is quoted in London at 2*s*. 6*d*. per ounce.

PLUMBAGINEÆ.

PLUMBAGO ZEYLANICA, *Linn.*

Fig.—*Rheede Hort. Mal.* x., *t*, 8; *Wight Ill.*, *t.* 179.

Hab.—Throughout India. The root.

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PLUMBAGO ROSEA, *Linn.*

Fig—*Rheede Hort. Mal. x., t. 9; Bot. Mag. tt.* 230,5363.

Hab.—Sikkim, Khasia wild? Cultivated in India.

Vernacular.—Chitrak, Chita (*Hind.*), Chitra (*Guz.*), Chitraka (*Mar.*), Chita (*Beng.*), Chitri (*Can.*), Chittira (*Tam.*), Chitra, Agnimata (*Tel.*), Kotu-veli (*Mal.*), *P. rosea* bears the same names with the addition of the adjective *red.*

History, Uses, &c.—These plants, in Sanskrit Chitraka, are described as digestive, light, astringent, hot and appetizing; a remedy for dyspepsia, piles, leprosy, anasarca, worms, cough, phlegm, wind and biliousness. In the Nighantas, among other synonyms, they bear the names Dáruna, Dahana, and Agni, in allusion to their burning and acrid properties. *P. zeylanica* is much used as a stimulant adjunct to other preparations, in the form of a combination called *Trimada*, consisting of Plumbago root, Báberang (fruit of *Embelia Ribes*), and Nágarmoth (tubers of *Cyperus pertenuis*). It enters into the composition of numerous medicines for dyspepsia. The following is an illustration: Take of Plumbago root, Rock salt, Chebulic myrobalans and long pepper, equal parts; powder and mix. Dose about 40 grains. (*Chakradatta.*) A favourite medicine for flatulence is an old prescription of Susruta's called Shaddharanayoga. It is a powder composed of equal parts of the following substances: Plumbago root, seeds of *Holarrhena antidysenterica*, roots of *Cissampelos Pereira*, of *Picrorrhiza Kurroa* and *Aconitum heterophyllum*, Chebulic myrobalans. Dose about 1 drachm. The root of *P. zeylanica* is said to exercise a beneficial effect on piles, in which disease it is given in various combinations. One mode of administering it is as follows:—An earthen jar or pot is lined in its interior with a paste of the root, and curdled milk (dadhi) or Kanjika (rice vinegar) is prepared in this pot. Plumbago root reduced to a paste is applied to abscesses with the object of opening them. It enters also into the composition of several prepara-

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tions used as caustics. Religious mendicants attending fairs use the root for the purpose of raising sores upon their bodies in order to obtain pity and alms. In the Concan the following formula is used:—Chitrak root, Emblic myrobalans, small black myrobalans (Bál-hartaki), Long pepper, Pepper root, Rhubarb and Rock salt. Powder and give 6 mashas (90 grains) with hot water every night at bed-time in flatulence with rheumatic pains.

In paralysis, the bark, with Cratæva bark, Indian elm bark (Vávalá), Wild Moringa bark, and the bark of *Vitex trifolia,* is boiled in one part of white, and two of black mustard oil and applied. Mahometan writers treat of the drug under the name of Shítaraj, a corruption of the Indian name Chitrak; they describe it as caustic and vesicant, an expellant of phlegmatic humors; useful in rheumatism and spleen, digestive; it also causes abortion. For external administration it is made into a paste with milk, vinegar or salt and water. Such a paste may be applied externally in leprosy and other skin diseases of an obstinate character, and be allowed to remain until a blister has formed. In rheumatism it should be removed after 15 to 20 minutes. When administered internally the dose is one dirhem. Mír Muhammad Husain speaks of several kinds of Shítaraj, and says one of them is the Líbádiyún or Lífádiyún of the Greeks. Rhazes describes two kinds, Indian and Syrian.*

The Shítaraj of Mahometan writers must, therefore, be considered to refer to the genus *Plumbago,* and not to any particular species. *P. zeylanica* is mentioned by several European writers upon Indian drugs, but has not attracted the same amount of attention as *P. rosea,* which is said to be more active. However, this may be, the former is the Chitrak of the native physicians, and very possibly may have been used

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* *Plumbago europæa* is considered to be the τριπολιον of Dioscorides by Sprengel. λιβάδιον or *fel terræ* is the name of a plant mentioned by Pliny (25, 31), which has not, we believe, been identified by European writers with Plumbago.

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by some under the supposition that it was the root of *P. rosea.* In the *Pharmacopœia of India*, Dr. Oswald is said to have employed *P. zeylanica* in the treatment of intermittents with good effect. It acts as a powerful sudorific. In many parts of India the root is one of the most important drugs of the itinerant herbalist; it is also sold by all druggists. Ainslie, speaking of *P. rosea*, remarks.—"The bruised root of this plant is, in its natural state, acrid and stimulating, but when tempered with a little bland oil, it is used as an external application in rheumatic and paralytic affections; it is also prescribed internally in small doses for the same complaints, in combination with some other simple powder." (*Mat. Ind., II., p.* 379.)

O'Shaughnessy, who instituted a series of trials with the root as a vesicant, has expressed a very favourable opinion of it as a cheap substitute for cantharides. Dr. Waring thinks less favourably of it; he found that it caused more pain than an ordinary blister, and that the resulting vesication was less uniform, and not always easily healed. From what we have seen of its use, we are inclined to support Dr. Waring's opinion. Given internally in large doses, Plumbago root acts as a narcotico-irritant poison. In small doses it acts first as a powerful stimulant of the mucous membrane of the digestive organs, and after absorption, as a stimulant of the excretory glandular organs. Its action is well worthy of accurate scientific investigation.

Description.—The roots of *P. zeylanica* are from ¼ to 2 or more inches in diameter, seldom branched. When dry, the external surface of the bark is of a dark reddish brown colour, somewhat shrivelled, and marked here and there by small warty projections; internally it is brown and striated; the fracture is short; the taste acrid and biting. Wood hard, reddish, close-grained. A section of the fresh bark when magnified shows numerous bundles of bright yellow stone cells forming an irregular zone towards the inner part of the middle layer of the bark. The cells of the parenchyma are large and contain much starch. In the dried root the yellow plumbagin

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is seen in the cell walls both of the parenchyme and the woody tissue, but not in a crystalline form. (*Flückiger and Gerock.*) The root of *P. rosea* has a similar structure, but is much smaller.

Chemical composition.—The activity of the drug depends upon the presence of *plumbagin.* This acrid principle was first separated by Dulong from the root of *P. europæa* by repeatedly boiling the ethereal extract with water, whence it was deposited on cooling, and purified by crystallization from alcohol or ether-alcohol. Plumbagin crystallizes in delicate needles or prisms, often grouped in tufts; has a styptic saccharine taste, with acrid biting after taste; melts very easily, and partly volatilises unaltered when heated. It is neutral, nearly insoluble in cold, more soluble in boiling water, very soluble in alcohol and ether. It dissolves with yellow colour in strong sulphuric and fuming nitric acid, and is precipitated by water in yellow flocks. Alkalies change the colour of the solution to a fine cherry-red; acids restore the yellow colour. Flückiger (1887) examined the root of *P. zeylanica* supplied by one of us, and found that plumbagin could be obtained by submitting it to steam, when the latter is carried off by the water, from which it can be separated by shaking with ether. On evaporating the ether fine crystalline tufts of plumbagin of a bright orange colour are obtained; they have a peculiar odour and an intensely acrid, but not bitter taste. On heating them but very moderately, they are volatilized; they readily dissolve in alkaline solutions and impart to them a red colour, but at the same time the plumbagin is altered, probably by oxidation. The yield is very small, from about 50 lbs. of root only 31 grains of raw plumbagin could be obtained. Professor Flückiger found the proportion of plumbagin in *P. europœa* to be about the same as in *P. zeylanica.* An acid was also separated from the root by distillation. M. Greshoff, who has been investigating the chemistry of the medicinal plants of Java (*Meded. uit S'lands Plant.* VII., p. 55, Batavia, 1890,) is of opinion that the roots (supposed to be from *Rauwolfia serpentina*) examined by

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Wefers Bettink (*Haaxmans Tijdsch.*, Jan., 1888,) were really those of *Plumbago rosea*. Prof. Bettink extracted with chloroform a yellow crystalline principle, apparently the plumbagin of Dulong, which on crystallization from hot water and several times from alcohol was obtained in needles melting at 72° C., and showing the composition $C^{16}H^{13}O^{6}$. It was with difficulty soluble in water, but easily soluble in chloroform, benzol, carbon bisulphide and glacial acetic acid. On careful heating it sublimed, the yield was about 0·2 per cent. The principle somewhat resembled Juglone and possessed anthelmintic properties.

A further examination *P. europæa* made in 1889 by Prof. Flückiger and Mr. T. E. Gerock, showed that plumbagin is not contained in the aërial parts of the plant, with the exception of a small quantity in that part of the stem which is near the root. They found the root, when freshly cut, to be nearly devoid of colour, but on exposure it immediately assumed a yellow hue, from which they conclude that the plumbagin is probably the product of a rapid oxidation of some primary substance contained in the plant. In the dried root the plumbagin is seen in the cell walls both of the parenchyme and of the woody tissue, but not in a crystalline form. We have submitted to steam two cwts. of bazar plumbago root, and on shaking the distillate with ether obtained half a fluid ounce of a deep yellow oily fluid having a peculiar penetrating odour. On cooling it artificially, a few colourless crystals formed, which redissolved when the oil was gently warmed. The oil floated on water, and the mixture was unaffected by dilute acids and alkalies and salts of iron, lead, mercury and silver; it dissolved readily in ether and bi-sulphide of carbon, and to a small extent in rectified spirit. It struck a reddish colour, without dissolving in sulphuric acid. A drop of the oil in a watch glass was solidified by passing the vapour of ammonia over it. Heating on a water bath for two days was not sufficient to dissipate the whole of the oil. Heated to 250° for some time it turned reddish brown, and a yellowish fatty body was given off and occupied the higher part of the tube. A few drops of the oil smeared upon the upper part of the arm was not vesicating, and occasioned no inconvenient symptoms.

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The distillate, from which the oil had been removed, was strongly acid; it was neutralized with baryta. The barium salt thus obtained treated with dilute sulphuric acid, yielded after agitation with ether a yellow oily principle similar to that which had been separated from the distillate by ether. There appears to have been no plumbagin in this root; it had the usual appearance of the drug as met with in commerce, and when received was quite fresh and moist, and had to be dried before it could be powdered. Further operations upon large quantities of the fresh and dried root will be necessary before the nature of this substance can be determined, for at present the physical properties of the principle, the so-called plumbagin, are not sufficiently well known to enable one to positively assert whether it is odourless or not, while its chemical constitution has not been studied.

Toxicology.— Chevers (*Med. Jurisp.*, p. 252,) refers to two fatal cases of poisoning from the internal administration of the root; one of these was homicidal.

In Madras Plumbago was little used before 1882. In 1882 and 1883, it formed 12 per cent. of the cases in which poison was detected in Class A (Human Cases, Viscera examined); in 1888, two cases in 51 were detected; and in 1889, two in 101. In Class B (Suspected Attempts to Poison); in 1883, one in eight; in 1884, one in eight; in 1885, one in seven; and in 1887, one in two of the poisons detected was plumbago. The drug had variously been administered by sorcerers to persons accused of theft, or as an abortifacient, or as a love potion to women. The symptoms were nausea, vomiting, and burning pain in the throat and inability to pass urine. The affected persons were found to have sore mouths, feeble irregular pulses and cold skins. In Bombay, Dr. Lyon finds plumbago root chiefly used for the purpose of causing abortion. With this object it is sometimes given internally, but is usually employed as a local irritant application to the os uteri, a portion of the root or a twig of the plant being pushed into the vagina and sometimes into the uterus. In some cases the cotton-covered end of an abortion stick is smeared with a paste made from the powdered roots.

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The following table shows the particulars of Plumbago poisoning in India :—

Presidency.	Year.	Human Viscera. Plumbagin.	Substances suspected to be or to contain poison.		Remarks.
			Plumbagin.	Plumbago root or Lalchitra.	
Bengal	1882	2	......	1	"In two stomachs examined in connection with abortion cases, evidence was obtained of the presence of *Plumbagin*, the active principle of *Plumbago rosea* (Lalchitra). According to Norman Chever's Manual of Medical Jurisprudence for India in some ascertained cases *lalchitra* has been given internally as an abortive. As a rule, however, the root is applied either to the neck of the uterus or introduced into the vagina. Chevers also records two instances in which men were poisoned by the drug."
Do.	1884	......	......	2	"*Plumbago rosea* was found in connection with two cases of alleged criminal abortion, one of the cases occurring at Dacca and the other at Ghattal. This plant is extensively used in producing criminal abortion. A piece about 6 inches in length is introduced into the os uteri and there produces intense irritation and vesication which results in abortion when the woman is pregnant. In 1882-83, however, this drug was found in the stomachs of two women, who were alleged to have died from the effects of abortion."

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Presidency.	Year.	Human Viscera. Plumbagin.	Substances suspected to be or to contain poison.		Remarks.
			Plumbagin.	Plumbago root or Lalchitra.	
Bengal	1885	......	......	1	
Do.	1886	......	......	1	
Do.	1887	......	......	2	
Do.	1888	......	......	2	
Do.	1889	......	......	1	
Madras	1881	......	......	1	
Do.	1882	1	......	4	"As this poison has very seldom been detected in this Presidency, all of the cases of poisoning by Plumbago are briefly noticed." "In the first case a woman was suspected to have been drugged, in order to facilitate robbing her, by something given in rice flour. The poison was detected in the vomited matter, and also in a suspected powder. The woman seems to have suffered severely, but fortunately had the benefit of skilful treatment, from the Medical Officer, Satur, from whom a careful and intelligent record of the symptoms of the case was received." "In the second case an insane man was reported to have died suffering from vomiting and purging shortly after taking a red powder given him by a native doctor.

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Do.	......	...	......	......	......	A small quantity of Plumbago was found to be present in a suspected powder received for examination. But the proportion of Plumbago to comparatively inert constituents was not so great as to prohibit the possibility of the powder having been a *boná fide* medicine. No traces of poison could be detected in two lots of sand believed to contain vomited matters, or on the soiled cloth worn by the deceased, or in the stomach." " In the third case a man was reported to have died shortly after taking some medicine. Symptoms were briefly described as purging and vomiting." " Plumbago was detected in the viscera and in a suspected medicine. The case seems very similar to the preceding one. In the fourth and fifth cases, which were simultaneously received from Cuddapah, it appeared that in each instance medicine had been taken from an old woman for the cure of venereal disease. In one of these cases, it was alleged that the old woman had been bribed by a rival bazaar man to give a fatal dose. In both these cases, poison was detected in the vomited matter and unexpended medicine. Whatever the true history of the cases may have been, there seems no doubt that the patients were very nearly killed."
Do	......	1883	18	......	......	The report in 1883 reviews the work of 1882 and a part of 1883; after this it was changed from the official to the calendar year. In the report for 1884, when reviewing the work for 1883, it is mentioned that in examining the human viscera or evacuations for poisons, *Plumbago zeylanica* was detected in 18 instances and one in Class B.

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Presidency.	Year.	Human Viscera. Plumbagin.	Substance suspected to be or to contain poison.		Remarks.
			Plumbagin.	Plumbago root or Lalchitra.	
Madras—*contd.* ...	1884	......	......	......	"Plumbago (*Plumbago rosea* or *zeylanica*) was found in one case. It was believed to have been used as an abortifacient."
Do.	1886	......	1	......	A love potion given to a woman was found to contain this poison.
Do.	1887	2	......	......	One given as a purgative medicine.
Do.	1889	2	......	......	One given as an abortifacient.
Bombay	1875	......	1	......	"In another case of the same kind some pills were found to contain a vegetable principle, resembling in characters Plumbagin, the active principle of *Plumbago rosea* or Lalchitra."
Do.	1881	......	3	......	"1, A case from Bijapur, in which some pieces of root alleged to have been used for the purpose of procuring abortion were identified as pieces of the root of the *Plumbago zeylanica*; 2, a case from Sangamner, in which some pieces of stick stated to have been used for the purpose of procuring abortion, were found to be armed at the end with cotton covered with a paste in which, on chemical examination, Plumbagin, the characteristic principle of *Plumbago rosea* and *zeylanica*, was detected; 3, a case from Nasik, in which again Plumbagin was detected in a red paste, and also in matters

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					staining a piece of cloth found in the house of a woman accused of an attempt to procure abortion."
Do.	1885	......	1	......	"In a case from Satara of death after abortion, Plumbagin, the characteristic principle of *Plumbago rosea* and *zeylanica*, was detected in a lump of paste found lying in the vagina of the deceased. In this case arsenic was also detected in minute quantity in the liver."
Do.	1888	......	1	......	"A case from Pandharpur (Sholapore District), in which some drugs found on searching the house of a reputed sorcerer were forwarded for examination. The man was accused of administering a narcotic drug to a woman, in order, it was said, that while under its influence, she might give a clue to the offender in a case of theft. From the symptoms, the drug administered was probably datura. The drugs forwarded were some roots and powders. Of these the roots were found to be Plumbago roots, and a number of the powders were found to contain Plumbagin and a mercurial compound."
N. W. P.	No case recorded.				
Punjab	No case recorded.*				

* The following case of the use of Plumbago is recorded in Dr. Brown's book on "Punjab Poisons" Case.—*Transactions of the Medical and Physical Society*, Bombay, paper read by Dr. J. Mill :—

On December 16th, 1861, a man poured over the face of a sleeping native, with whom he had quarrelled, a liquid, said to have been prepared from the roots of *Plumbago rosea* and *Semecarpus Anacardium*, but this also contained some blistering flies and sulphate of copper. Six days afterwards he was seen by Dr. Mill, who described the whole of the face, neck and left side of the chest as being covered by a deep black slough, the paiu was very great: the next day the slough separated and the man appeared better, but 35 days after the injury, he died from exhaustion."

Commerce.—The root is sold at Rs. 4 to 5 per maund of 37½ lbs. The Bombay market is supplied from Kattiawar and Guzerat, where the shrub grows to a much larger size than it does in the Concan.

PRIMULACEÆ.

DIONYSIA DIAPENSIÆFOLIA, *Boiss.*

Fig.—*Clusius Exot.* i. *p.* 199.

Hab.—Persia. The plant.

Vernacular.—Hamáma (*Arab., Ind. Bazars*).

History, Uses, &c.—The recent discovery by Mr. E. M. Holmes of the botanical source of Hamáma (*Pharm. Journ.*, 1887,) enables us better to understand the description by Dioscorides of the *amomon* of the Greeks. His chapter περὶ ἀμώμου has always puzzled the commentators; it has an hiatus in the middle; there are several doubtful readings in the text, and a paragraph which appears to have got into it by mistake. In the edition of 1529 we read φύλλα δε βρυονια (*sic.*) ὁμοια and in the same edition, where bryony is treated of, the word is printed βρυωνία in the usual manner. This creates a suspicion that the true text may have had moss, and not bryony; we can then read the description of the first kind of amomon as follows—"Amomon is a small shrubby plant (θαμνίσκος) like a bunch of intertwining woody stems; it has a small flower like the wallflower (λευκόιον); the leaves are like those of moss; the best is the Armenian, of a golden tinge, with reddish yellow stems, sufficiently fragrant. This would agree very well with the characters of the genus Dionysia. Dioscorides then proceeds to describe the kind found in Media, differing somewhat from the first, and smelling like *peganon*. So far the Arabian version is much the same as the Greek text, but it omits the next paragraph from τον δε πόντικον to 'υπερυθρον, where the hiatus occurs, and begins the description of the third kind thus—"A third kind is the Coptic," &c., evidently quite a different drug from the first two.

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Throughout the remainder of the chapter the Greek and the Arabian versions agree, with the exception that the latter omits all mention of *Amomis*.

The conclusion of the chapter in Dioscorides is noteworthy; he says—"In the selection of these articles it is important to avoid broken pieces, and to choose such specimens as have entire branches springing from a single root;" this is applicable to hamáma, but not to cardamoms.

Theophrastus (9, 7, 1) merely mentions cardamomon and amomon as coming from Media. Celsus (*lib.* V.) mentions amomum and cardamomum as ingredients in a "Malagma adjecur dolens." Pliny (13, 1,) speaks of amomum as an Assyrian shrub with a white flower, from which a costly perfume was made. In short there is no medical description of the drug except by Dioscorides.

The non-medical classical writers mention amomum, but they allude to it in a vague way, or as a precious perfume.

In Virgil's third *Eclogue*, Damœtas says:—

> "Qui te, Pollio, amat, veniat, quo te quoque gaudet:
> Mella fluant illi, ferat et rubus asper amomum."

Among the Arabians Ibn Sina (Avicenna) only notices one kind of Hamámá, "Shajrat kánkood min khashab mushabbak" (a plant with latticed woody branches, the first kind of Dioscorides); but he remarks that it affords a sticky exudation. Sheik Dawood of Antioch, who wrote A. D. 1656, says: "Hamámá, is in Greek amomiya, and its flowers are called leukáin, it is not *bruwaniya*, which is a name for *fashara.* The plant consists of sticks latticed together in a bunch of a reddish-golden colour, acrid, hot, perfumed; it springs from a single root, hard, perfumed; it grows in Armenia and Tarsus, and a kind of it in Syria is greenish and small, or yellowish and fragile, both spurious; and it grows in the month of Nisan (April); it has reddish flowers, like those of the Wallflower or Sádaj."

The Persian writers give similar descriptions, but that of Haji Zein el Attar (A. D. 1368) is more original. He says:—"Hámámá, amámún or amúman in Persian *Mahilú*, hot and

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dry in the second and some say in the third degree. It is of two kinds, one is well-known, and is called in Shiraz mahilu, and there is another kind like *Persiawashán* (maiden-hair), and like it, of a reddish yellow colour; the leaves are green and small, and the flowers yellow and small, and the plant is about a span high, or in my experience less. It grows on stones. The best is of a golden colour from Armenia, and has a sweet smell."

Mr. E. M. Holmes has found in the Herbarium of the British Museum a specimen of *Dionysia diapensiæfolia*, Boiss, bearing an inscription in the handwriting of Kotschy, which states that the plant grows on stones, as stated by Haji Zein. He has also ascertained that the Persian drug is aromatic; possibly Armenia may furnish a more perfumed plant belonging to the same genus. We see nothing in the description of Dioscorides to connect Amomon with Cardamomon. On the other hand, his description of Cardamomon is very short, and such as he would naturally give of an article so well known as this must have been from its every-day employment by Asiatics as a masticatory and spice. In addition to this, he notices a use of cardamoms peculiar to India, namely, as a lithontriptic in nephritis and dysuria. The description of Dioscorides is as follows:—" Cardamomon is brought from Commagene (the northern province of Syria, now Camosh), Armenia, and the Bosphorus, but it is produced also in India and Arabia. Choose that which is tough, well-filled, closed; if not in this state, it is too old and has lost its aroma. The taste is pungent and somewhat bitter.

We think there can be no doubt that the Greeks were well acquainted with Cardamons through their intercourse with Eastern nations long before the time of Dioscorides, although they had no exact information as to their source. As suggested by Mr. Holmes, the *Amomis* of Dioscorides was probably a plant having the same characters as his true amomum.

The Pontic and Coptic kinds were probably entirely different plants used as substitutes. We must also bear in mind that

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plants having no very remarkable properties were used by the ancients, and are still used in the East, as ingredients in perfumes, &c., from some superstitious fancy in connection with them.

The Hamama now in use in the East was known in Europe as Amomum in the 14th and 15th centuries, and is figured by Clusius (*Exot. Lib.* I., p. 199). He calls it *Amomum spurium*. The same drug was found in use in Egypt by Prosper Alpinus, 1580-83. Dr. Leonhart Rauwolff, who travelled in the East (1573-76) for the purpose of studying the drugs of Dioscorides, says of Amomum: "Lastly amongst the rest I did also enquire after the amomum and thought, because they were near unto the confines of Armenia (*i. e.*, the bazars of Aleppo), that therefore they might easily have it by the caravans which come daily from those parts, yet I was forced to run a great while after it, till at length I got a little stock thereof in one shop. They call it by the name of Hamama. But of the other so-called by Dioscorides, which is like unto it, and therefore may easily be taken for the right one, they had a great deal. These two small shrubs, although they are very like to one another, yet for all that they may be distinguished by their stalks and different colours, wherefore Dioscorides bids us (if we will not be imposed upon) to pick out the bigger and smoother, with its noble seed, and to leave the small. This stalk which I found about the length of a finger, is almost of the colour of the bark of the cinnamon tree, and also in its acrimony and good odour (although it was old) still very strong. At the top had been several woody stalks close to one another, whereon I believe had been the flowers and seeds. But the twigs of the other sort, which are crooked and bended, are of a brown colour, which at the top divide themselves into other less ones like a tree, whereon grow several stalks, with little heads like unto the Masaron, or *Marum Syriacum* from Crete, wherein is no great strength nor odour." (*Ray's Collection of Curious Travels and Voyages*, 1693, *quoted by C. C. Bell in a letter to the Pharm. Journ., Jan.* 28th, 1888.)

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Hamama is applied as a poultice to boils and scorpion stings, &c. Taken internally it is considered sedative and is thought to promote the action of the liver and spleen and to remove obstructions in those organs. It is also prescribed in gout and in uterine obstructions, both internally and externally. The dose is 2 dirhems.

Description.—The following is Boissier's description of the plant (*Diag. Ser.* 17, *p.* 65) :—Densissime et late cæspitosa, ramis ob folia vetusta dense imbricata columnaribus; foliis minute hirto-glandulosis, planis, sub-flabellatim reticulato-venosis, ovatis et oblongo-spathulatis, basi attenuatis obtusissimis, integris vel obtuse utrinque 1—2 crenatis; pedunculis subnullis, rosulæ foliis occultatis vel paulo longioribus, breviter exsertis; 1 rarius 2—3, floris, floribus involucro 3—5 bracteato suffultis; bracteis lineari-spathulatis, obtusis, integris, calycem æquantibus; calyces ad ¾-partiti, laciniis lineari-spathulatis obtusis, corollae luteæ glanduloso-hirtæ, tubo calyce quadruplo longiore, limbi ampli laciniis ovatis retusis. Cœpites lati, 3—4 pollices elati, folia 1½—2 lineas longa, calyx 2½ lineas, corolla 10—12 longa.

Pedunculis exsertis et involucro affinis *D. cæspitosæ*, sed in hac pedunculus longus, bracteæ majores incisæ, calycis laciniæ acutæ, corollæ limbus minor.

The seeds of Hamama are elliptic or subtriangular, concave on the outer side and bluntly keeled on the other; brown in colour, and rugulose with netted markings. The average length $\frac{5}{10}$th of an inch.

Chemical composition.—The plant contains a light brown resin, which becomes covered with a glaucous film on exposure to the air; it is soluble in sulphuric acid and in aqueous alkaline solutions with an orange colour. The taste is at first pungent and warming, afterwards acrid, with a sialogague action. A crystalline body is separated from the alcoholic extract, soluble in water, and responding to alkaloidal tests, but otherwise acting as a neutral substance. Some free fatty acids are also removed by alcohol from the plant. The seeds

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examined separately yielded to ether 24 per cent. of brown fat, melting at 29° C. This fat on saponification yields some fragrant volatile fatty acid; a mixture of insoluble fatty acids melting at 41°, soluble in spirit and crystalline; and a neutral, brown, fluorescent resin.

No substance like cyclamin was found in the infusion of the whole herb. The seeds contained ammonia from the decomposition of the albuminoids. The herb afforded 16·9 per cent., and the seeds 11·1 per cent. of mineral matter.

ANAGALLIS ARVENSIS, *Linn.*

Fig.—*Eng. Bot. viii. t.* 529; *xxvi, t.* 1823. Scarlet Pimpernel (*Eng.*), Mouron rouge (*Fr.*).

Hab.— Many parts of India, Europe, Western Asia. The herb.

Vernacular.— Jonk-mári, Jainghani (*Hind.*).

History, Uses, &c.— Dioscorides describes two kinds of ἀναγαλλὶς, the male with red flowers, and the female with blue flowers. According to him the herb has lenitive properties, and is used to subdue inflammation, to assist in the extraction of thorns from the flesh, and in the cure of sores. The juice administered through the nostrils is said to remove pituitous matters from the head and relieve toothache; mixed with honey it removes films from the eyes and improves the sight. Given with wine, it was thought to be an antidote for the poison of the viper; it was also prescribed to relieve pain in the kidneys and liver, and to promote the dispersion of dropsical swellings.

The female plant was supposed to cure *prolapsus ani* and the male plant to incite that disease. Pliny (25, 92) speaks of the plant to the same effect. The Arabian and Persian physicians repeat the words of Dioscorides with slight additions or variations, but remark that large doses have an injurious effect upon the stomach; they call the plant Anághális, but in modern Arabic it is known as Marijáneh. The old European physicians recommended the use of Anagallis in mania and melan-

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choly, and Quercitanus made it a speciality in his treatment of mania. Ravenstein and Gwelin record cases in which persons bitten by rabid animals were cured by the use of this herb; it was administered internally and also applied to the bitten part.

Most of these physicians considered it to be an efficacious remedy in gout, dropsy, and pulmonary complaints. Orfila places Anagallis among the narcotico-acrids, and gives the following account of its effects upon animals:—"At eight in the morning three drachms of the extract of pimpernel, prepared by evaporating in a water-bath the juice of the fresh plant, were introduced into the stomach of a robust dog. At six in the evening he was dejected, and at eleven sensibility appeared diminished. The next morning, at six, he was lying down, apparently dead, and might be displaced like a mass of inert matter. He expired half an hour after. The mucous membrane of the stomach was slightly inflamed; the interior of the rectum was of a bright red colour; the ventricles of the heart were distended by black coagulated blood; the lungs presented several livid spots, and their texture was preternaturally dense. Two drachms of the same extract, applied to the cellular tissue of a dog's thigh, caused death in twelve hours with the same symptoms as the preceding. M. Gronier gave to horses some tolerably strong doses of the decoction of this plant, and he observed almost constantly a trembling of the muscles of the posterior extremities as well as those of the throat, and a copious flow of urine. After death the mucous membrane of the stomach was found inflamed."

In India, Anagallis is used as a fish-poison, and also to kill leeches, which sometimes get lodged in the nostrils of those who frequent the jungles in the rainy season. Both the blue and the red flowered varieties are found in Western India; the blue being the common one eastward.

Description.—Root small, stem branched from the lower part, often dotted with purple, more or less procumbent, square. Leaves sessile, ovate, many-ribbed, dotted with purple at the back. Peduncles angular, longer than the leaves,

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twisted and recurved after flowering. Corolla bright scarlet, with a violet coloured mouth; its edges finely crenate, or minutely fringed with glands. Fruit pale and transparent, the size of a pea. Seeds roughish. The plant has a somewhat bitter and acrid taste.

Chemical composition.—D. Malapert (1857) has shown that the poisonous properties of the plant are due to the presence of a substance similar to, if not identical with, *Saponin*. J. A. Heintzelman obtained a small quantity of volatile oil from the dry herb, and found it of a strong peculiar odour and a pungent and acid taste. A few drops produced headache and nausea lasting for several hours.

CYCLAMEN PERSICUM, *Miller.*

Fig.—*Bot. Mag.*, *t.* 44. Sow-bread (*Eng.*), Arthanite, Pain de pourceau (*Fr.*)

Hab.—Persia. Levant. The tubers.

Vernacular.—Bakhúr-i-Miryam (*Ind. Bazars*).

History, Uses, &c.—Under the name of κυκλάμινος, a species of Cyclamen is mentioned by Greek medical writers, which Fée considers to have been *C. hederæfolium*, Ait., and Littré *C. græcum*, Lam.: it was also called ἰχθυόθηρον, "fish-taker," from its being used to kill fish, and according to Theophrastus was used as a love charm. It is described as having emetic, purgative and hydrogogue properties, and was considered to be useful as an emmenagogue, as an antidote to the poison of snakes, and when locally applied, as a resolvent of tumours. The juice was blown into the nose to purge the brain; mixed with wine it is said to have intoxicating properties. The plant was supposed to cause pregnant women to abort if they walked over it, and the dried root was worn by men as an amulet to protect them against spells. Pliny (25, 67) calls it Cyclaminos, and states that it is known in Italy as *Tuber terræ*; he repeats much of what Dioscorides says about its medicinal properties. The Arabian physicians under the

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names of Artanitha and Bakhúr Miryam reproduce what Dioscorides has written concerning Cyclamen. Persian writers describe the Persian plant under the names of Azarbu and Chubak-ushnán, and state that it is a kind of Artanitha. The Indian Mahometan writers follow the Arabs and Persians. The different species of Cyclamen were formerly used in Europe on account of their emetic, purgative, and diuretic properties, and an ointment prepared from the root was applied to the abdomen of adults to produce vomiting or purging, and over the bladder to induce diuresis; it was also applied to the navel of children suffering from intestinal worms, and to scrofulous tumours. Bulliard states that it is still used in the north of France as a purgative and often produces emesis, cold sweats, giddiness and convulsive movements. Pigs are said to eat the root with impunity, but fish are easily poisoned by it, and frogs sicken and die after a few days. Schroff, who has experimented with cyclamin, comes to the following conclusions:—1, Cyclamin does not act upon the sound skin; 2, in the mouth it produces a very unpleasant sensation and taste, and excites salivation; 3, in the stomach it causes burning, oppression, nausea, and vomiting, and in this organ, as in the intestine, it occasions inflammation; 4, in the connective tissue it excites inflammation, which may be followed by gangrene: 5, it does not affect the brain, spinal marrow, or nerves; 6, it salivates men when not taken by the mouth, but by the veins; 7, its action is analogous to that of saponin. (*Stillé and Maisch.*)

Description.—These plants have a roundish, tuberous, or fleshy root stock, from the upper side of which spring the leaves and flowers, sometimes directly from the top, sometimes from a short neck-like stem. The leaves are roundish or ovate with a deep basal sinus, sometimes angular at the margins and often marbled with greyish white. The flowers have the segments of the corolla turned back. The capsule is five-valved, and after flowering the scape in most of the species coils up spirally with the seed vessel in the centre, bending itself at the same time towards the ground. Porta considers

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that the root "suo circinato bulbo muliebrem uterum affabre demonstrat effigiatum."

Chemical composition.—The activity of the plant depends upon a principle similar to, if not identical with, saponin. Saladin (1830) named it cyclamin. It has a bitter acrid taste, forms a soapy mixture with water, and when boiled with acids is converted into glucose and a resinous substance which has been named cyclamiretin. Fish poisoned by it die asphyxiated through imperfect respiration. (*Gmelin*. 15, 343; 16, 200.)

MYRSINEÆ.

EMBELIA RIBES, *Burm.*

Fig.—*Burm. Fl. Ind.*, *t.* 23; *Lam. Ill.*, *t.* 133.

Hab.—Throughout India. The berries.

Vernacular.—Viranga, Váyvirang, Bábirang (*Hind.*), Biranga (*Beng.*), Vávadinga (*Mar.*), Váyvirang (*Guz.*), Váyu-vilangam (*Tam.*, *Tel.*), Vàyubilaga (*Can.*).

History, Uses, &c.—The Sanskrit name is Vidanga; it has many synonyms, such as Vrisha-násana, "destroyer of the enemy" (worm); Suchitra-vija and Chitra-tandula, "having variegated seeds." Susruta describes the fruit as anthelmintic, alterative and tonic, and recommends its use along with liquorice root for the purpose of strengthening the body and preventing the effects of age. In the Nighantas it is described as bitter, pungent, hot, astringent, appetizing and light; useful for the removal of abdominal pains, worms, wind and skin diseases. The berries enter into the composition of several applications for ringworm and other skin diseases.

Under the names of Birang-i-Kabulí and Biranj-i-Kabulí notices of the drug will be found in Mahometan works. The hakíms consider it to be attenuant and a purgative of phlegmatic humours; also a valuable anthelmintic, especially against tapeworms. Ibn Sina describes it as a strong anthel-

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mintic. Mir Muhammad Husain notices that it turns the urine red. He fixes the dose at three dirhems of the powder, and directs it to be given with fresh milk. Rheede figures a plant which appears to be *Embelia robusta*, and states that the seeds kill worms. Ainslie has the following short notice of it:—"Babreng is the Hindooie name of a vermifuge seed, common, I have been given to understand, in the higher provinces of Bengal, the Sanskrit name of which is Chitratandoola. What the plant is I know not." Roxburgh gives a full botanical description of the plant, and remarks that the berries are used to adulterate pepper. Royle notices their aperient properties. Váyvirang is in high repute as an anthelmintic among the country people, especially in cases of tapeworm, a disorder common among the Native Christians of the Coast. The dose is a teaspoonful of the powder twice a day for a child, and a dessertspoonful for an adult; it can hardly be called purgative; the taste is rather pleasant, slightly astringent, and faintly aromatic. The worm is expelled dead. A purgative should be given to prepare the patient for the drug. It is a common practice to put a few berries of this plant in the milk that is given to young children; they are supposed to prevent flatulence.

Recently Dr. Harris (*Lancet, July 23rd*, 1887) has directed attention to the value of this drug as a remedy for tapeworm. He states that he has administered it for several years with good results to natives of India and Europeans; he gives one to four drachms with milk and curds early in the morning.

Description.—The fruit is globular, of a dull red, and grows in large bunches; it is rather smaller than a peppercorn. The dried fruit has the five partite calyx and stalk often attached; the outer shell is striated from the base to the apex, where there is a small beak; its colour is reddish brown, marked with dark spots; inside the outer shell is the seed, enveloped in a delicate membrane, on removing which a cup-like hollow is seen opposite the insertion of the stalk. The seed is horny, of a reddish colour, and its external surface

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appears to be covered with spots of white mildew: this appearance however, with the aid of a lens, is seen to be due to a delicate crystalline efflorescence. If kept for any time the outer shell of the fruit becomes much darker. From the rapidity with which this change takes place, we would suppose the quality of the drug to be not affected by it.

Chemical composition.—Warden (*Pharm. Journ., Jan.* 1888) separated from the fruit a substance in the form of brilliant golden spangles having the properties of an acid, which, with caustic soda, potash and ammonia, gave wine-red solutions.

He obtained crystalline compounds of this acid with soda, potash and ammonia, and provisionally named it *Embelic acid.* In a further communication to the same Journal (*Oct. 20th,* 1888), he says:—"The embelic acid used for ultimate analysis was repeatedly crystallized from absolute alcohol, and the soft crystalline mass thus obtained strongly pressed between layers of cloth to remove mother-liquor. The resulting cake was freed from alcohol by exposure to air, reduced to powder, and finally dried at 100° C. in the water oven for some hours.

On combustion with cupric oxide in a current of oxygen in an open tube, the following results were obtained:—

A—·2696 gram gave ·6920 gram CO^2 and ·2308 gram H^2O.
B—·2534 „ ·6506 „ „ ·2106 „ H^2O.

From these figures the following percentage composition is deduced:—

	Carbon.	Hydrogen.	Oxygen.
A	70·000	9·495	20·405
B	70·019	9·234	20·747
Mean	70·009	9·364	20·627

These percentages lead to the formula $C^9H^{14}O^2$, as is seen by the following comparison:—

	Theory.		Found.
9 equiv. of carbon	108	70·129	70·009
14 „ hydrogen	14	9·090	9·364
9 „ oxygen	32	20·781	20·627
	154	100·000	100·000

In order to determine the molecular formula, compounds of silver and lead with embelic acid were examined. In preparing the metallic salts of embelic acid, as the acid is insoluble in water, alcoholic solutions neutralized with ammonia—any excess of ammonia being driven off by prolonged boiling—were mixed with hot alcoholic solutions of silver and lead. The resulting precipitates were allowed to subside, washed with water by decantation, thrown on a filter and washed with alcohol, then with ether, thirdly with water, and finally again with alcohol and ether. The precipitates were very difficult to wash, owing to caking, and during the operation a certain amount of decomposition appeared to occur. Thus, in preparing the lead and silver salts, after mixing the solution of embelic acid with an excess of the metallic solution, the supernatant liquid, when the precipitate had subsided, was colourless; but on washing the precipitate with alcohol and ether, the filtrate was coloured yellow, and after prolonged washing with water, the filtrates afforded evidence of the presence of silver or lead, and then when alcohol and ether were used for the final rinsings the filtrates were again coloured yellow.

Ignition of the silver salt, after having been dried at 100° C., indicated that it contained 40·653 per cent. of the metal, which gives 264·9 as the molecular weight of the salt, and 158 as the molecular weight of the acid, the acid being represented by the formula $HC^9H^{13}O^2$. The silver salt would have the formula $AgC^9H^{13}O^2$, which requires the following theoretical percentage:—

Carbon	41·432
Hydrogen	4·987
Silver	41·302
Oxygen	12·279

The composition of the salt as determined by analysis afforded the following percentages:—

Carbon	41·544
Hydrogen	5·557
Silver	40·653
Oxygen	12·246

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Two analyses of the lead salt afforded 37·781 and 37·810 per cent. of lead, respectively, which gives a mean percentage of 37·795 as the lead content of the salt. Taking the lead salt to be represented by the formula $(C^9H^{13}O^2)^2Pb''$, its theoretical percentage composition would be—

Carbon	42·154
Hydrogen	5·074
Lead	40·282
Oxygen	12·490

while the actual percentage as determined by analysis gave the following figures :—

Carbon	43·545
Hydrogen	5·824
Lead	37·795
Oxygen	12·836

A comparison of the theoretical and found percentages for the silver and lead salts indicates differences which can only be accounted for by assuming that the salts were partially decomposed during preparation.

Embelic acid was found to have a melting point of 139·5° C. to 140° C. (uncorrected), when it forms a deep ruby liquid. At about 155° C. it commences to decompose; indications of a portion having sublimed were noted.

The following colour reactions were obtained by adding the respective re-agents to dilute alcoholic solutions of the acid :—

Ferric chloride, a dirty brownish-red colour.

Ferrous sulphate, brownish colour.

Chloride of zinc, violet colour.

Phosphomolybdic acid, light green precipitate.

Plumbic acetate, dirty green precipitate.

Nitrate of silver, dirty reddish-brown precipitate.

Embelic acid is insoluble in water, and is not decomposed by being boiled with dilute sulphuric or hydrochloric acid.

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Salts of embelic acid with soda, potash and ammonia were prepared. The ammonia salt was the one most readily obtained crystalline. When an alcoholic solution of embelic acid was mixed with strong ammonia in excess, and the deep red resulting liquid allowed to evaporate spontaneously, the salt crystallized in large needle-shaped crystals of a foxy red hue.

The ammonium salt was found to be effective as an anthelmintic for tænia in doses of 3 grains for children and 6 grains or more for adults. It would appear to act in cases in which the ordinary tæniacides fail. The best method of administration is to give the salt with a little honey or simple syrup, the drug being preceded and followed by castor oil. The ammonium salt of embelic acid possesses one very important advantage over the liquid extract of male fern—it is tasteless—and may thus prove a useful addition to our materia medica.

Lascelles Scott has found in the fruit a minute quantity of volatile oil with a spicy flavour, a fixed oil, colouring matters, a resinoid body, an alkaloid of a yellowish white colour, which he has named *Christembine,* and a tannin. The dried fruit as sold in the Calcutta bazars is generally mixed with pepper corns, and the volatile oil mentioned by Scott may be due to this admixture.

Commerce.—The fruit of *E. robusta* is collected and sold under the same name as that of *E. Ribes.* Moodeen Sheriff has observed two varieties of the drug offered for sale in Madras. The drug has lately been exported to Germany to some extent. Value, Rs. 2½ per maund of 37½ lbs.

SAPOTACEÆ.

BASSIA LATIFOLIA, *Roxb.*

Fig.—*Roxb. Cor. Pl., t.* 19; *Bedd. Fl. Sylv., t.* 41.

Hab.—Central India, W. Bengal to Western Ghâts, Kumaon, Terai.

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BASSIA LONGIFOLIA, *Linn.*

Fig.—*Wight Ill., t.* 147; *Bedd. Fl. Sylv., t.* 42.

Hab.—Malabar Coast, Ceylon. The flowers and oil of the seeds.

Vernacular.—Moha (*Hind., Mar.*), Maua (*Beng.*), Mahudo (*Guz*), Illupai (*Tam.*), Ippa-chettu (*Tel.*), Ippa-gida (*Can.*). *B. latifolia* is sometimes distinguished by the addition of the adjective "wild" or "forest."

BASSIA BUTYRACEA, *Roxb.*

Fig.—*Roxb. in Asiatic Researches,* viii. *p.* 499—502. Indian butter tree (*Eng.*).

Hab.—Sub-tropical Himalaya. The oil of the seeds.

Vernacular.—Phúlwára, Chiára, Cheuli, Cheuri (*Hind.*), Yelpot (*Lepcha.*).

History, Uses, &c.—These trees are called in Sanskrit Madhuka, Madhudruma, "honey tree," Madhupushpa, "honey flower," Madhusakha, Madhusravas, Gudapushpa "sugar flower," and Kolaphala, or "the fruit of the Kols," a wild tribe inhabiting the hills and forests of Central India, who subsist, to a great extent, upon the fleshy flowers which they collect and dry. The milky juice of the bark, Madhuka-sára, is described as a remedy for phlegm and rheumatism, astringent and a promoter of suppuration; the flowers as sweet, strengthening and cooling; the fruit as cold, sweet and strengthening; it is thought to be antibilious and anti-rheumatic, and useful in leprosy and skin diseases. The spirituous liquor prepared from the flowers is called Madhu-mádhavi or Madhvásava, and is described by Susruta as heating, astringent, tonic and appetizing. The flowers, seeds and oil obtained from them, are more or less used as food all over India, and in many districts form a very important addition to the dietary of the agricultural classes. For further information upon this subject we

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would refer our readers to "The Dictionary of Economic Products of India," by Watt (Vol. I., p. 405—416). Ibn Batuta, who visited India A.D. 1332, mentions مهوا (Mahwa), and remarks that the flowers, when dried in the sun, taste like figs. The Persians have named these trees *Darakht-i-gul-chakán* on account of their deciduous flowers. In Guzerat the Mahometans manufacture a coarse soap from the oil of the seeds with soda and lime; this soap varies in price according to the amount of oil it contains. Medicinally, Bassia oil is used as an emollient application to the skin, and the cake as a detergent for washing the hair, and also as an emetic. The oil of *B. butyracea*, known as *Phúlwa butter*, may be used in the preparation of *Ung. Hydrarg. Nitratis* in the same manner as Kokam butter (See *Garcinia indica*). The bark of the Bassias is used in decoction as an astringent. From the flowers a coarse kind of molasses may be prepared. Bassia spirit when rectified loses its offensive odour, and may be used for pharmaceutical purposes. The ordinary native distilled spirit is very rich in fusel oil: one of us found as much as ·4 per cent. in a sample of Mahwa spirit. In the Bengal districts in which the spirit is made, the fermentation is conducted in earthen vessels containing 10 to 20 gallons of fluid, 10 to 20 seers of the flowers being a charge. The jar is then filled up with spirit wash and water, and the process of fermentation occupies from 3 to 7 days, depending on the temperature. The stills are of the rudest description. Molasses and other materials are sometimes added to the contents of the vats. The amount of spirit obtained varies with the quality of the flowers: Warden's experiments would indicate that on an average one maund will yield about 2·12 gallons of London proof spirit when treated in the manner usual among native distillers. In some districts a composition called *bakha* or *muli* is added to the contents of the fermenting vats; it is stated to be composed of herbs and roots, which are dried, ground, and made up into balls with flour. About half a seer (1 lb.) is added to one maund (80 lbs.) of raw material. In certain cases dhatura, nux vomica seeds and other poisonous substances are added to these balls.

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The use of bakha has been prohibited in Government distilleries in Calcutta and its suburbs. For further information on Mahwa spirit, we would refer the reader to the report of the Commission of 1883-84 on the excise of country spirit in Bengal. A kind of gutta-percha has been prepared from the milky juice of *B. latifolia*, which has the consistence of ordinary gutta, but is more adhesive and hardens much more rapidly. Used alone it cannot replace the gutta of commerce, but mixed with an equal proportion of that article, it may be used to make the moulds required in galvanoplastic operations; the mixture is as easily manipulated in hot water as ordinary gutta. (*Heckel and Schlagdenhauffen.*)

Description.—Bassia bark is thick and red coloured, with a rough brown surface and astringent taste. The trees produce cream-coloured flowers in March and April, and in August a reddish-yellow fruit from 1 to 2 inches long, which contains from 1 to 4 seeds; these are light brown, about 1¼ inch long and ¾ of an inch broad, irregularly ovoid in shape, with a large scar on one side and a ridge on the other, terminating in two slight prominences; the shell is thin and brittle, and the seed consists of two large oily cotyledons, easily separated, white when fresh, but soon turning brown when kept. They yield a greenish-yellow oil, which becomes a solid white mass in the cold weather; that of *B. butyracea* remains solid at 35° C., whereas the oils of *B. latifolia* and *B. longifolia* melt at 25·3° C.

The dried flowers at a little distance have the appearance of raisins, on closer inspection they are seen to be fleshy, sticky, compressed, hollow bodies, about $\frac{6}{10}$ of an inch long, and nearly as broad, with an aperture at both ends, the upper being much the larger and serrated. Upon being soaked in water they assume an almost globular form, and the numerous anthers are seen attached by very short filaments to the inside of the corolla. The taste is acid and sweet. The fleshy substance of the corrolla, which is about $\frac{1}{10}$ of an inch in thickness and translucent, consists of a parenchyma which may be divided

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into two portions: an outer or cortical, consisting of smaller cells, and an inner consisting of large cells; it is traversed by numerous bundles of spiral vessels; some of the cells contain crystalline masses of sugar; all of them granular matter; there is no starch.

The seeds are from 1 to 2 inches long, and enclosed in a chestnut coloured thin shell; they have a peculiar odour and bitter aromatic taste. The latex of these trees is a milky liquid, sticky to the touch, when kept it developes a rancid sour odour; it contains, besides the gutta-percha, some starch and about 88 per cent. of water.

Chemical composition.—Bassia flowers have been examined by Church (1886), who found them to have the following composition:—

Cane sugar	3·2
Inverted sugar	52·6
Other matters sol. in water	7·2
Cellulose	2·4
Albuminous substances	2·2
Ash	4·8
Water at 100° C.	15·0
Undetermined matter	12·6

MM. A. Riche and A. Rémont (*Journ. de Pharm. et de Chim.*, 1880,) found in the flowers of *B. longifolia* 60 per cent. of fermentable sugars and 8·50 per cent. of crystallizable sugar.

—

In a paper read before the Society of Chemical Industry, 1887, Mr. H. S. Elsworthy gave the composition of trade samples of the flowers of *B. latifolia*:—

		Saccharose.	Invert sugar.	Dextro-glucose.	Total Sugar.
1.	Hyderabad	17·1	40·0	...	57·1
2.	Jubbulpore	4·6	41·4	...	46·0
3.	Guzerat	9·6	45·3	...	54·9
4.	Mirzapore	6·7	...	43·6	50·3

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The seeds of *B. longifolia* have been examined by E. Valenta (*Dingl. Polyt. Journ.* ccli., 461). One hundred parts dried at 100° C. gave—

Fat (light petroleum extract)	51·14
Matters soluble in absolute alcohol	78·3
Tannin	2·12
Bitter principle sol. in water	0·60
Starch	0·07
Vegetable mucilage	1·65
Albuminous substances soluble in water.........	3·60
Extractive substances soluble in water	15·59
Insoluble proteids..................................	4·40
Total ash..	2·71
Fibre and loss	10·29
	100·00

Ash in the soluble portion 0·95 per cent.

Total proteids.............. 8·00 ,,

For the extraction of the fat, light petroleum boiling at 40°—45° was used. The fat has a yellow colour and greasy consistency; but on exposure to the air and light the colour disappears and the fat soon becomes rancid. It has a specific gravity of 0·9175 at 15°, melts at 25°·3, solidifies at 17°·5—18°·5. It contains considerable quantities of free fatty acids, but only a small amount of glycerol. One gram of the fat requires 192·3 mgrms. of KHO for the complete saponification of the fatty acids. It is partly soluble in alcohol, and perfectly soluble in ether, carbon bisulphide, benzene, &c. The fatty acids obtained by saponifying the fat with potash-ley, and decomposing the resulting soap by means of a ten per cent. solution of hydrochloric acid, have a white colour, and pleasant odour and taste. They melt at 39°·5, solidify at 38°, and dissolve readily in alcohol. According to Schädler the butter consists of 80 per cent. of stearin and 20 per cent. of olein; the author, however, found that it contained palmitin and olein.

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The ash of the seeds is yellowish-white, and dissolves almost completely in water. It gives by analysis—

Silicic acid and portion insoluble in nitric acid	10·67
Phosphoric acid	15·47
Sulphuric acid	6·81
Carbonic anhydride	7·46
Ferric oxide and alumina	2·01
Lime	0·64
Potash with traces of soda	56·68
Moisture and loss	0·26

—(*Year-Book of Pharmacy*, 1886, p. 174.)

According to MM. E. Heckel and F. Schlagdenhauffen (*Journ. de Pharm. et de Chim.*, 1889,) the latex of *B. latifolia* has the following composition:—

Water		87·40
Acid formic (trace) and acid acetic		0·50
Insol. in water 1·666	organic matter	1·405
	ash	0·261
Sol. in water 0·172	tannin and gum	0·125
	ash	0 047
Sol. in alcohol	resin α	2·043
Sol. in acetone	resin β	2·824
Gutta-percha		1·803
Ash		3·792
		100·000

The gutta-percha is flesh-coloured, tolerably hard at ordinary temperatures, but softens when worked with the hand and becomes sticky; dried at 105° C. it loses about 60 per cent. of water; strongly pressed and dried on a water-bath, it becomes light brown, gradually hardens, and becomes covered with a white efflorescence, which dissolves at once in chloroform and bisulphide of carbon, and less easily in cold alcohol. Boiling alcohol and acetone dissolve ¾ of its weight; the solution filtered whilst hot deposits a grumous mass, without any trace of

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crystals. The alcohol and acetone solutions when concentrated afford a syrupy, colourless, transparent fluid, which, when completely dry, presents the appearance of gum, and is easily powdered. Concentrated sulphuric acid colours this substance yellow and afterwards brown; the addition of chloroform does not change the colour. On the addition of a trace of ferric chloride to this mixture and allowing it to stand, a rose-coloured upper layer forms, which gradually becomes blue. This reaction much resembles that of cholesterine, but is not due to the presence of that substance. Heated with fuming nitric acid, picric acid is not formed; concentrated hydrochloric acid, caustic potash and fused potash have no action on it. Warmed in a test tube it decomposes slowly and does not yield any crystalline product on cooling. Its formula is $C^8H^{12}O$. The portion insoluble in alcohol and acetone has the consistence of ordinary gutta-percha, but is more adhesive, and hardens much more readily than that substance. On combustion it leaves a white ash consisting of sulphate of lime with a trace of chloride and phosphate of sodium. (*Heckel and Schlagdenhauffen.*)

We find the bark of *B. longifolia* to contain 3 per cent. of caoutchouc, extracted by benzol; 17 per cent. of tannin, extracted by water; and some oxidized tannin removed subsequently by spirit or alkali. The bark contains starch and rhomboid crystals of calcium oxalate, and leaves 9·42 per cent. of ash when burnt.

The bitter principle contained in the seeds is probably saponin.

Commerce.—No definite information concerning the internal trade in the flowers is obtainable, but its value has been estimated at not less than 35 lakhs of rupees. For several years large quantities were exported from Bombay to France. In 1881-82, the exports were 57,000 cwts.; in 1882-83, 68,829 cwts., valued at Rs. 1,61,317; and in 1883-84, 227,114 cwts., valued at Rs. 5,70,879. In 1885 their import into France was prohibited by the French Government, as it was found to materially interfere with French interests.

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The oil and seeds are exported to some extent for candle making. The value of the oil in Europe has been estimated at about £35 per ton.

MIMUSOPS ELENGI, *Linn.*

Fig.—*Wight Iç., t.* 1586; *Bedd. Fl.Sylv., t.* 40.

Hab.—Deccan Peninsula. Cultivated elsewhere. The bark, flowers, fruit, and oil of the seeds.

Vernacular.—Maulsiri (*Hind.*), Ovali (*Mar.*), Bakul (*Beng.*), Bolsiri (*Guz.*), Mogadam (*Tam.*), Pogada-mánu (*Tel.*), Halmadhu (*Can.*), Taindu (*Central Prov.*).

History, Uses, &c.—This highly ornamental tree, with dark green, oblong, alternate leaves and small white fragrant flowers, which turn to a tawny yellow colour before they fall, is very common in gardens in India. It is the Vakula, Kesara and Sinha-kesara, "lion's mane" of Sanskrit writers. Chakradatta mentions the astringent properties of the unripe fruit, and recommends it to be chewed for the purpose of fixing loose teeth. He also mentions a decoction of the astringent bark as a useful gargle in diseases of the gums and teeth. In the Concan a similar use is made of the unripe fruit, and the fruit and flowers along with other astringents are used to prepare a lotion for sores and wounds. Mír Muhammad Husain notices the practice of planting this tree on account of its handsome appearance. He says that the unripe fruit and seeds have powerful astringent properties, and that the decoction of the bark is useful as an astringent in discharges from the mucous membrane of the bladder and urethra, and also as a gargle in relaxation of the gums, &c. He mentions the use of a snuff made from the dried and powdered flowers in a disease called Ahwa, common in Bengal. The symptoms of this disease are strong fever, headache and pain in the neck, shoulders and other parts of the body. The powdered flowers induce a copious defluxion from the nose and relieve the pain in the head. The flowers are much used by the natives on account of

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their perfume, which they retain when dry; pillows are sometimes stuffed with them, and they afford a distilled water. The juice of the bark and unripe fruit is used by silk dyers to fix colours. Rumphius states that the pounded leaves are applied to cure headache, that a decoction of the root is given in angina, whilst a plaster made from them is applied externally. The ripe fruit pounded and mixed with water is given to promote delivery in childbirth. (*Hort. Amb.* III., 17.) Horsfield (*Asiat. Journ.* VII. p. 262) describes the bark as an astringent tonic, and Dr. Bholanauth Bose states that a decoction of it forms a good gargle in salivation. (*Pharm. of India*, p. 131.)

Description.—The substance of the bark is red, it is covered externally by a very thick grey suber on the older branches, which separates in irregular scales, leaving isolated attached portions which consist of five or more distinct suberous layers; the inner surface is red and presents a coarsely striated surface; fracture short, disclosing white specks and stains in the substance of the bark caused by the drying up of the milky juice which it contained when fresh. The taste is bitter, astringent and mucilaginous.

The flowers are white and fragrant; calyx inferior, eight-leaved, in a double series; leaflets lanceolate, the four exterior ones leathery, larger and permanent; corolla one-petalled, tube very short, fleshy, border composed of a double series of segments; the exterior one consists of sixteen, spreading; the interior one of eight, generally contorted, and converging, all are lanceolate, a little torn at their extremities; nectary eight-leaved, conical, ragged, hairy near the base, inserted alternately with the filaments into the mouth of the tube, converging filaments eight, short, hairy; anthers linear, sharp-pointed below, two parted, converging. The berry is oval, smooth, when ripe yellow, and edible, one or more celled, according to the number of seeds that ripen; seed solitary, oblong, compressed, attached to the bottom of the cell, covered with a smooth, hard, thick integument, lined with a veined membrane; perisperm conform to the seed, two-lobed, pointed at the base, the

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lobes uniting round the radicle; above the radicle they are often entirely divided by the large cotyledons, which extend to, or rather through its margins; embryo erect; cotyledons large, oval; plumule minute; radicle inferior, linear oblong. (*Roxburgh.*)

Chemical composition.—A decoction of the bark afforded 20·3 per cent. of extract containing 6·8 per cent. of tannin. Some caoutchouc, wax, colouring matter (probably oxidized tannin), starch, and 9·4 per cent. of ash were also obtained from the bark.

Mimusops hexandra, *Roxb., Cor. Pl. i., t.* 15; *Wight Ic., t.* 1587; a native of the Deccan Peninsula and Ceylon, cultivated in Northern India, has much the same properties as *M. Elengi.* The vernacular names are Kshiri (*Hind.*), Khirkhejur (*Beng.*), Rájana, Kerni (*Mar.*), Ráyan (*Guz.*), Palla *Tam.*).

The Sanskrit name is Rájádani. The dried fruit is known as *Kàkadia* in Guzerat, and the fresh fruit is sold in the streets in Bombay under the name of *Ahmadábádi-mewa.*

It is a handsome tree, with rigid branches and broad wedge-shaped leaves, and is often found planted in groves near Mahometan towns and buildings. The wood is tough, and is much used for making sugar mill beams, well-frames, &c. The ripe fruit is eaten both fresh and dried, and the bark which much resembles that of *M. Elengi* is used medicinally on account of its astringent properties. In the Concan the white milky juice, which exudes when the tree is wounded, is made into a paste with the leaves of *Cassia Fistula* and seeds of *Calophyllum inophyllum,* and applied as a maturant to boils. The seeds yield an oil which, according to Dr. Mootooswamy, is used as a demulcent, emollient, tonic and alterative in South India.

Chemical composition.—The tannin in this bark was identical with that found in the bark of *M. Elengi.* The bark examined was younger and afforded 10·3 per cent. of tannin,

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giving a greenish precipitate with ferric salts, and 30 per cent. of oxide on the ignition of its lead compound. It contained also a resin, wax, caoutchouc, colouring matter, starch, and 7·5 per cent. of mineral residue.

The fixed oil from the seeds is of a light yellow colour, tasteless and odourless, and solidifies at a temperature a little above 15° C. At 17° it has a specific gravity of ·9186. The saponification equivalent is 266·3, as the oil requires 21·1 per cent. of caustic potash to form a complete combination with it. The oil yields 94·5 per cent. of insoluble fatty acids melting at 37°, and containing some stearic acid.

The fruit juice evaporated by heat leaves a blackish extract or paste having a pleasant flavour and sweetness. The extract contains 70 per cent. of sugar, which answers to levulose or fruit sugar. It also contains a yellow resin soluble in ether, alcohol, and benzol, and some caoutchouc. Pectin, colouring matter and a small quantity of tannin occur in the soluble portion of the juice.

ACHRAS SAPOTA, *Linn.*

Fig.—*Bot. Mag., tt.* 3111—3112; *Gärt. Fruct.* 2, *t.* 104. Sapodilla plum, Bully tree (*Eng.*), Sapotillier (*Fr.*).

Hab.—West Indies. Cultivated in India. The bark, fruit and seeds.

Vernacular.—Chiku (*Mar.*).

History, Uses, &c.—This tree has become completely established as a fruit tree on the Western Coast, and in Bengal, and its fruit is regularly offered for sale in the markets. In other parts of India it appears to be less common. In the West Indies and South America the bark is used as a tonic and febrifuge, and the seeds are used as a diuretic in six grain doses; larger doses are said to be dangerous, and a case of poisoning by them has been recorded by Leprieur. In India the fruit is much esteemed by the natives, who consider that, if soaked in melted butter all night and eaten in the morning, it

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prevents bilious and febrile attacks. We have not seen the bark or seeds used, nor do the natives appear to have noticed their medicinal properties. The tree yields a kind of gutta-percha similar to that of other sapotaceous plants.

Description.—The bark is red with a grey suberous outer coat; it has a bitter and strongly astringent taste. The fruit is ovoid externally rusty brown and rough, internally yellowish white, soft and pulpy; when quite ripe it has a medlar-like flavour. The seeds are black, shining, ovoid and elongated.

Chemical composition.—Bernou (*L'Union Pharmaceutique*, 1882,) separated from the bark two resins, one of which is soluble in ether, 11·8 per cent. of tannin, and the alkaloid *sapotine*, which is soluble in alcohol, ether, and chloroform, and is precipitated from its salts by ammonia.

EBENACEÆ.

DIOSPYROS EMBRYOPTERIS, *Pers.*

Fig.—*Bot. Reg., t.* 499; *Bedd. Fl. Sylv., t.* 69; *Roxb. Cor. Pl. i., t.* 70; *Rheede Hort. Mal. iii., t.* 41. Indian Persimmon (*Eng.*), Plaqueminier Glutinifère (*Fr.*).

Hab.—Throughout India. The fruit.

Vernacular.—Taindu (*Hind.*), Gáb (*Beng.*), Tumbilik-kay (*Tam.*), Tumiki, Tinduki (*Tel.*), Panich-chi (*Mal.*), Timburni, Temar (*Mar.*), Temru (*Guz.*).

History, Uses, &c.—*D. Embryopteris* is the Tinduka of Sanskrit writers; its bark is described in the Nighantas as a good application to boils and tumours, and the juice of the fresh bark as useful in bilious fever. The fruit when unripe is said to be cold, light, and astringent, and when ripe beneficial in blood diseases, gonorrhœa and leprosy. A kind of

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Tinduka called Visha-tinduka, "poisonous tinduka," is said to have similar properties; as well as a plant called Kanki or Kinkini. Mir Muhammad Husain, speaking of Ebony, mentions *Gàb* as a kind of Indian ebony, but is silent as to its medicinal uses. Rheede (*Hort. Mal iii.*, p. 46), speaking of *D. Embryopteris*, says—"Arboris cortex in pulverem redactus ac cum oryzæ infuso, et expresso e matura nuce Indica lacteo succo mixtus, atque febricitantibus exhibitus æstum potenter extinquit; ex seminibus oleum exprimitur." The circumstance that the unripe fruit abounds in an astringent viscid juice, which is used by the natives of India for daubing the bottoms of boats, was communicated by Sir William Jones to Roxburgh in 1791. The introduction of the fruit into European medical practice in India is due to O'Shaughnessy. In 1868 it was made official in the *Pharmacopœia of India.* The fruit is eaten by the poorer classes. The seeds are preserved by the country people and given as an astringent in diarrhœa. The testa is the astringent part, the albumen being almost tasteless. Although the ripe fruit is very sweet, insects will not touch it.

Description.—Fruit subglobose, 1 to 2 inches in diameter, sometimes larger; glandular or rusty, yellow when ripe, and covered with a rust-coloured farina consisting of clubbed hairs. Seeds 8 in the perfect fruit, often less by abortion, arranged vertically round the central core, reniform, immersed in glutinous pulp. Fruiting calyx much accrescent, lobes ¾ inch, ovate, auriculate, base cordate, nearly glabrous.

Diospyros fruit is very astringent until quite ripe, when it becomes mawkish and sweet. This is noticed in the *Pharmacographia*, but not in the *Indian Pharmacopœia*, where unripe fruit should have been ordered.

Chemical composition.—The tannic acid of these fruits has the following reactions. A blue-black colour with ferric chloride; violet-black colour and precipitate with ferrous sulphate; pinkish precipitate with gelatine; curdy precipitate with iodine in potassium iodide; orange sediment with bromine

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water; brown precipitate with cupric acetate; yellowish brown precipitate with potassium dichromate; aqueous alkalies afforded precipitates which changed in colour and became soluble by oxidation; grey precipitate with limewater, turning red by exposure to the air; it reduced the copper when boiled with Fehling's solution. The lead compound of the tannic acid contained 48·78 per cent. of oxide, whether prepared from the aqueous or alcoholic extract of the fruit. Boiled for two hours with dilute hydrochloric acid, the astringent principle was decomposed with the formation of two colouring matters and a body answering to glucose. The inspissated juice was not redissolved entirely even in boiling water, about thirty per cent. of pure soluble tannin was obtained from it, the remainder was an insoluble gum swelling up like tragacanth. The amount of astringent acid obtainable from the fruits examined by us was 12·8 per cent., and we consider it to be closely related to gallotannic acid.

Several species of Diospyros have fruit with the astringent properties of *D. Embryopteris* when unripe. The root of **D. Tupru** is used by the Marathás to make the Akshata mark (the sectarial circlet on the forehead), under the name of Akshatéché khor, "akshata wood." The leaves are an article of commerce, being largely used for folding *viri*, "native cigarettes." The fruits contain 5·7 per cent. of tannic acid.

D. Ebenum affords Ebony, the 'Abnus' of the Mahometan Materia Mèdica. It is described as astringent, attenuant, and lithontriptic, and was used by the ancients. (*Cf. Dios.* i., 114; *Pliny* 12, 8.)

The fruits of **D. montana** contain a very interesting colouring matter, which seems to be the chief ingredient besides sugar and malic acid but no tannic acic. The colouring matter is soluble in spirit and partly so in water. It is insoluble in ether, and gives an intense purple with alkalies. Subjected to hydrolosis it breaks up into a body soluble in ether, also pigmental, and a sugar. The fruits are used by the hill-men of Travancore for poisoning fish.

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D. Kaki, a tree of China and Japan, cultivated in some parts of India, has an edible fruit which is known as the Chinese Persimmon. The fruit is green, globular, from two to three inches in diameter, and when ripe has an agreeable sweetness and flavour. The dried and powdered fruit contained 54·2 per cent. of sugar reducing Fehling's solution, an organic acid, no tannin, and a colouring matter soluble in ether similar to that of the fruits of *D. montana.*

The following shows the proximate analyses of the dried and powdered fruits freed from the seeds of four species of Diospyros:—

	Embryopteris.	Tupru.	montana.	Kaki.
Ether extract..............	1·2	2·1	10·0	1·5
Spirit extract	12·4	6·3	6·8	66·1
Water extract	7·5	4·4	6·3	11·5
Albuminous matter, &c...	12·1	16·4	12·5	3·0
Organic residue...........	61·9	65·1	58·6	14·1
Ash.........................	4·9	5·7	5·8	3·8
	100·0	100·0	100·0	100·0

STYRACEÆ.

STYRAX BENZOIN, *Dryander.*

Fig.—*Bentl. and Trim., t.* 169. Gum Benjamin tree (*Eng.*), Aliboufier de Benjoin (*Fr.*).

Hab.—Sumatra, Java, Siam. Gum Benzoin.

Vernacular.—Lubán, Ud (*Ind. Bazars*).

History, Uses, &c.—Benzoin or Gum Benjamin does not appear to have been known to the ancient Hindus, nor is there any evidence that the Greeks and Romans, or even

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the earlier Arabian physicians, were acquainted with it There is however no doubt that in the original and legitimate Storax they were acquainted with a fragrant resin in separate or more or less agglutinated tears, somewhat resembling Benzoin, and produced by the *Styrax officinalis* of Linnæus. Specimens of this amygdaloid storax are still to be found in old Materia Medica collections. (*Hanbury's Science Papers*, p. 129.) Benzoin is first mentioned by the Arabian traveller Ibn Batuta, who visited Sumatra between A. D. 1325 and 1349. He calls it Lubán Jáví or Java Lubán, Java being a general name among the Arabs and Persians for the Eastern Archipelago. It is not mentioned by the Persian druggist Háji Zein, A. D. 1368. In more recent Arabic and Persian works, Benzoin is called Hasi-lubán-el-Javi, which may be translated 'pebbly or amygdaloid frankincense from Java,' and seems to imply the existence of another kind of pebbly frankincense. The author of the *Makhzan-el-Adiwya* states that Hasi-lubán-el-Javi is the same as Darv or Zarv (ضرو). On turning to this article, we find the following synonyms given: Fúzúkas* (*Greek*), Zarwa (*Syrian*), Fashashísh (*Turkish*), Dur-i-haskhak Arísa, Kalangúra, and Kamkám (*Persian*). This tree is said to grow in the Hejaz, Yaman, India and other countries, and to resemble the oak, the leaves being soft and reddish at the edges, and the fruit a cone like the fir, but with larger seeds; its bracts and spines turn red when ripe. The exudation is at first like a grain of wheat, but gradually increases until it reaches the size of a melon; from it a dark pitch-like substance may be separated. A decoction of the leaves is mentioned, and an oil which is obtained from the seeds. This description might do for *Liquidambar orientale*, but cannot apply to *Styrax Benzoin*. As regards the drug benzoin, Mir Muhammad Husain must have been well acquainted with it, as it was in common use in India before his time. He probably regarded it as a kind of amygdaloid storax. Ainslie mentions its use in Southern India by Tamool physicians as a remedy in phthisis and asthma.

* Probably a corruption of ζυγὸς, a name applied to the Storax tree by the modern Greeks.

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The Mahometans use it for the same purpose, and direct the fumes to be inhaled. As an incense it is much used by all classes, the imports into Bombay alone averaging 6,000 cwts. per annum. For the early history of this drug in Europe, the *Pharmacographia* may be consulted. In that work will also be found a summary of what is known regarding the method of collecting it in Sumatra and Siam.

Description.—The following excellent description, together with a summary of its chemical composition, is extracted from the *Pharmacographia* :—

"Siam Benzoin.—The most esteemed sort is that which consists entirely of flattened tears or drops, an inch or two long, of an opaque, milk-like white resin, loosely agglutinated into a mass. More frequently the mass is quite compact, consisting of a certain proportion of white tears of the size of an almond downwards, imbedded in a deep, rich amber-brown, translucent resin. Occasionally the translucent resin preponderates, and the white tears are almost wanting. In some packages the tears of white resin are very small, and the whole mass has the aspect of a reddish-brown granite. There is always a certain admixture of wood, bark and other accidental impurities.

"The white tears, when broken, display a stratified structure with layers of greater or less translucency. By keeping, the white milky resin becomes brown and transparent on the surface, but from some experiments made by one of us (F.) it does not appear that opacity is due to water, but rather to a peculiar molecular (semi-crystalline ?) state of the resin. Siam benzoin is very brittle, the opaque tears showing a slightly waxy, the transparent a glassy, fracture. It easily softens in the mouth, and may be kneaded with the teeth like mastich. It has a delicate balsamic, vanilla-like fragrance, but very little taste. When heated it evolves a more powerful fragrance together with the irritating fumes of benzoic acid ; its fusing point is 75° C. The presence of benzoic acid may be shown by

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the microscopical examination of splinters of the resin under oil of turpentine.

"Siam benzoin is imported in cubic blocks, which take their form from the wooden cases in which they are packed while the resin is still soft."

"SUMATRA BENZOIN.—Prior to the renewal of direct commercial intercourse with Siam in 1853, this was the sort of benzoin most commonly found in commerce.

"It is imported in cubic blocks exactly like the preceding, from which it differs in its general greyer tint. The mass, however, when the drug is of good quality, contains numerous opaque tears, set in a translucent, greyish-brown resin, mixed with bits of wood and bark. When less good, the white tears are wanting, and the proportion of impurities is greater. We have even seen samples consisting almost wholly of bark. In odour, Sumatra benzoin is both weaker and less agreeable than the Siam drug, and generally falls short of it in purity and handsome appearance, and hence commands a much lower price. The greyish brown portion melts at 95°, the tears at 85° C."

Chemical composition.—Benzoin consists mainly of amorphous resins perfectly soluble in alcohol and in potash, having slightly acid properties, and differing in their behaviour to solvents. If two parts of the drug are boiled with one part of caustic lime and twenty parts of water, benzoic acid is removed. From the residue the excess of lime is dissolved by hydrochloric acid, and the remaining resins washed and dried. About one-third of them will be found readily soluble in ether, the prevailing portion dissolves in alcohol, and a small amount remains undissolved. Subjected to dry distillation, benzoin affords as chief product *Benzoic acid*, $C^7H^6O^2$, together with empyreumatic products. Benzoic acid exists ready formed in the drug to the extent of from 14 to 18 per cent., its extraction is easily accomplished by the aid of an alkali, most advantageously by milk of lime, which does not combine with the amorphous resins. Most pharmacopœias require not the inodorous acid obtained by a wet process, but that afforded by sublimation, which contains a small amount of fragrant empy-

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reumatic products. The resin when repeatedly subjected to sublimation affords as much as 14 per cent. of benzoic acid.

Kolbe and Lautemann in 1860 discovered in Siam and Pennang benzoin together with benzoic acid, an acid of different constitution, which in 1861 they recognised as *Cinnamic Acid,* $C^9H^8O^2$. Aschoff (1861) found in a sample of Sumatra benzoin, cinnamic acid only, of which he got 11 per cent.; and in amygdaloid Siam and Penang benzoin only benzoic acid. In some samples of the latter, one of us (F.) has likewise met with cinnamic acid. (*Op cit.,* 2nd Ed., p. 407.)

Commerce.—The imports of Benzoin into Bombay in the year 1871-72 were 5,975 cwts., and the exports 1,043 cwts.; no later statistics are available, but there is probably little difference in the quantity imported. Average value in Bombay, first quality, Rs. 30 to Rs. 35 per maund of 37½ lbs. An artificial benzoin is manufactured in the bazar, in which pieces of silicate of magnesia are embedded in common American resin. It is largely retailed to the poor, who purchase small quantities for religious uses.

SYMPLOCOS RACEMOSA, *Roxb.*

Hab.—North-East India, Burma. The bark.

Vernacular—Lodh, Tilak (*Hind.*), Lodh (*Beng.*), Lodhra (*Mar.*), Lodhar (*Guz.*), Jáláriyaméd (*Can.*).

History, Uses, &c.—This tree, in Sanskrit Lodhra or Rodhra, Srimata, "propitious," and Tilaka, "because it is used in making the Tilaka mark on the forehead," is described in the Nighantas as hot, alterative, and useful in phlegmatic diseases and leprosy. In the Bhávaprakása it is said to be absorbent, stomachic, refrigerent, astringent, expectorant and hæmostatic, and to be useful in eye diseases, liver, fevers, dysentery and dropsy. A decoction of the bark is used as a gargle when the gums are spongy and bleeding. (*Susruta.*) It enters into the composition of various pastes which are applied

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to inflamed parts; it is supposed to promote the maturation and resolution of stagnant humours. In fevers, dysentery and liver complaints, compound decoctions and infusions are used, and in dysentery a compound powder containing liquorice root, *Myrica sapida* bark, and pomegranate rind in equal proportions to the Lodhra bark. (*Sarangadhara, Chakradatta.*)

Roxburgh remarks that the bark is in request among the dyers of red in Calcutta, and seems to be used as a mordant only. He gives the following receipt:—"For three yards of cloth take Lodh bark, Chebulic myrobalans of each 2 ozs., rub them down with water, then add more water, steep the cloth and dry it. Next take 2 ozs. of alum, dissolve it in water and boil the cloth in the solution for an hour, then wash and dry it. Lastly, take the bark of *Morinda tinctoria* and flowers of *Woodfordia floribunda* of each 2 ozs., Madder root 1 lb., mix them with lukewarm water and let it boil, then put in the cloth and keep it in the boiling liquid for forty minutes." In this receipt the Lodh appears to be used as a dye to modify the colour afterwards produced by the Morinda and Madder. The middle layers of Lodh bark contain much red colouring matter.

In Europe it was formerly looked upon as a cinchona bark, and has been known at various times as "*Ecorce de lautour,*" "*China nova,*" "*China Calafornica,*" "*China Brasilensis,*" and "*China Paraquatan.*" It is now known as "Lotur bark." Drs. Charles and Kanny Loll Dey recommend the bark in 20 gr. doses mixed with sugar as a remedial agent in menorrhagia due to relaxation of the uterine tissue; it should be given two to three times a day for three or four days. Dr. K. L. Dey considers that the drug has a specific action upon relaxed mucous membranes. (*Phar. Journ, Sept.* 24, 1881.)

Description.—The bark is very soft and friable, of a light fawn colour; the external surface corky and much fissured transversely; the internal of a lighter colour and fibrous texture. On making a transverse section a middle layer of a red colour is seen between the corky and fibrous portions.

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Microscopic examination shows that the coloured layer is chiefly composed of oblong cells containing red colouring matter; the inner layer of the bark consists almost entirely of woody fibre. The taste is faintly balsamic and astringent.

Chemical composition.—Dr. Hesse reports (*Ber. d. deutsch ch. Geselsch*, X., 1,) that he has obtained from this bark three alkaloids, which he has named "*Loturine*," "*Colloturine*," and "*Loturidine*," and between which he thinks probably there is the same relation as exists between cusconine, aricine, and cusconidine. Loturine is present in largest quantity (0·24 per cent.); it is crystalline, and forms crystalline salts. Colloturine is also crystalline but loturidine is amorphous. All three alkaloids in dilute acid solutions show an intense blue-violet fluorescence. Winckler obtained from this bark an alkaloidal substance which he named "*Californine*," but Hesse believes this to have been a mixture of the acetates of the three alkaloids. Pelletier, Caventou and Winckler have separated *Kinovin* (Quinovin) from the bark of *China nova*. Kinovin forms an amorphous, nearly transparent resin, triturable to a light, white powder, inodorous, or faintly balsamic when warmed. Tasteless at first, but afterwards very persistently and disagreeably bitter and acrid; neutral; electric when rubbed. (*Winckler, Hlasiwetz.*) In alcoholic solution it exerts a dextro-rotatory action on polarised light; $(a)\ j = 52{\cdot}4$ (De Vrij). Kinovin may be obtained in the anhydrous state by keeping it in a vacuum for a month, but cannot be dehydrated at once, even at a temperature of 190°: kinovin dried at 100° to 140° contains from 1 to 2 atoms of water, which is given off at 160° to 180°. (*Hlasiwetz.*) According to Hlasiwetz, kinovin corresponds with the formula $C^{60}H^{48}O^{16}$; according to Petersen the formula is $C^{15}H^{12}O^{4}$; according to Schnederman $C^{38}H^{30}O^{10}$. (*Gmelin, Handbook* xviii., p. 26.) The bark contains no tannin according to Hummel. The ash amounts to 7·4 per cent. containing 18 per cent. of carbonate of soda.

Commerce.—The bark is obtainable in all the Indian markets. Value, Rs. 3 to 3½ per Surat maund of 37½ lbs.

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OLEACEÆ.

NYCTANTHES ARBOR-TRISTIS, *Linn.*

Fig.—*Bot. Reg.*, *t.* 399; *Bedd. Fl. Syl.*, *t.* 240; *Gärtn. Fruct.* ii., *t.* 138. Weeping Nyctanthes, Night Jasmine (*Eng.*), Nictanthe Arbre-triste (*Fr.*), Arvore da notte (*Port.*).

Hab.—Central India. Cultivated throughout India. The leaves, fruit and bark.

Vernacular.—Harsinghár, Hár, Siháru (*Hind.*), Sephalika (*Beng.*), Pártaka, Khurasli (*Mar.*), Manja-pu (*Tam.*), Harsing (*Can.*), Poghada (*Tel.*), Pakúra (*Punj.*).

History, Uses, &c.—Royle in his Himalayan Botany states that this tree is extremely common along the foot of the mountains which skirt the Dehra Dhoon, and may be seen for several hundred feet above Rajpore in the ascent to Mussoorie. Dr. Wallich found it in a wild state near the banks of the Irrawaddy, on the hills near Prome. In all parts of India it is one of the commonest cultivated shrubs, its flowers open at sunset, and fall before morning; they have a very strong perfume. The Sanskrit names for the tree are Sephálika; Párijátaka; Rajanihása, "night-smiling"; and Atyúhá, "very pensive." According to the Indian legend, a certain Nága (prince) called Párijáta had a daughter of whom the Sun became enamoured, but he soon deserted her for another sweetheart; whereupon the damsel pined away and died of grief. Upon the spot where she died sprang up the tree Párijataka, whose flowers have such a dread of the Sun that they fall from the tree in the early morning before he rises.

Chakradatta mentions the use of the leaves in fever and rheumatism; a decoction of the leaves prepared over a gentle fire is recommended by several writers as a specific for obstinate sciatica. In the Concan about 5 grains of the bark are eaten with Betel-nut and leaf to promote the expectoration of thick phlegm.

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The author of the *Makhzan* gives a minute description of all parts of the tree, and states that the Indians use the white portion of the flowers as a purple dye, which they call Gulkámah, and the orange part as a yellow dye. The seeds and leaves are considered by them to have medicinal properties. Six or seven of the young leaves are rubbed up with water and a little fresh ginger, and administered in obstinate fevers of the intermittent type, at the same time a purely vegetable diet is enforced. The powdered seeds are used to cure scurfy affections of the scalp. Directions for the preparations of Gulkámah will be found in the *Karabádin-i-kabir.**

Description.—Tree, 15 to 20 feet, young shoots 4-sided, leaves opposite, short-petioled, cordate or oblong, pointed, entire, or coarsely serrate, scabrous; panicles terminal, composed of small six-flowered terminal umbellets, calyx campanulate, slightly 5-notched, downy; corolla tube cylindric, as long as the calyx, segments 5 to 7; involucel of four inverse-cordate, opposite, sessile leaflets; flowers numerous, tube orange-coloured, border white, fragrant. The fruit is a dry, flat, oblong, mucronate capsule, prominently veined, ¾ inch long by ½ inch broad; it is of a brown colour when ripe, and is divided into two cells, each of which contains a flat foliaceous seed of a light brown colour; the testa of the seed is thin, the kernel white, bitter and very astringent. The leaves have similar properties, and stain the saliva when chewed.

Chemical composition.—The fresh leaves were digested with 80 per cent. alcohol, and most of the alcohol recovered by distillation. The concentrated tincture deposited a large amount of resin and colouring matter on spontaneous evaporation. When the liquid had ceased to smell of alcohol, it was acidulated with dilute sulphuric acid, which caused the precipitation of a dark resin. After filtration the clear filtrate was neutralized with ammonia and agitated with ether. The ethereal solution was evaporated to dryness, mixed with dilute sulphuric acid and again agitated with ether: finally the aqueous acid

* A well-known Persian Pharmacopœia.

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solution was again neutralized and agitated with ether. Operating in this manner, an alkaloidal principle was isolated, which we provisionally call *Nyctanthine.* Nyctanthine gives a marked precipitate with alkaloidal reagents, but no special colour reactions. In addition to an alkaloid, the presence of a trace of an oily principle was detected, which had a taste somewhat similar to that of oil of peppermint. An astringent principle, giving a greenish coloration with ferric chloride, with resins, and a sugar readily reducing an alkaline copper solution on boiling, were also present.

Jasminum grandiflorum, *Linn.*, Spanish Jasmine or *Chambeli,* is cultivated almost everywhere in India. The Sanskrit name is Játi; from the flowers a perfumed oil is prepared which is a favourite perfume amongst the Hindus. Their physicians prescribe the leaves as a remedy in skin diseases, ulcers of the mouth, otorrhœa, &c. Chakradatta mentions the use of the fresh juice of the leaves as an application to soft corns, and of an oil prepared with it in otorrhœa. In the Bhavaprakása the leaves are recommended to be chewed by those who suffer from ulceration of the mucous membrane of the mouth.

Mahometan writers consider the plant to have deobstruent, anthelmintic, diuretic and emmenagogue properties. Mír Muhammad Husain mentions the use of the flowers applied in the form of plaster to the loins and pubes as an aphrodisiac. He classes *J. grandiflorum* along with several other kinds of Jasmine under the name of Yasmín.

Chemical composition.—The air-dried leaves were exhausted with 80 per cent. alcohol, and the alcoholic extract mixed with water and agitated with benzole. The benzole extract contained much colouring matter and some resin. During agitation with benzole, a soft black resin separated. This resin was easily soluble in alkalies and reprecipitated by acids. The clear aqueous fluid after agitation with benzole was acidulated with dilute sulphuric acid, which caused a turbidity. After filtration, the liquid was agitated with ether, the extract contained astringent matter, and salicylic acid. The aqueous

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solution was then rendered alkaline and reagitated with ether, the ethereal extract contained an alkaloid, for which we propose the name *Jasminine*, and which afforded no special colour reactions.

The *Mogra*, **J. Sambac**, is considered to have the the same properties as *J. grandiflorum*. In the *Pharmacopœia of India* the flowers, upon the authority of Mr. J. Wood, are said to have considerable power as a lactifuge; he speaks of them as effectual in arresting the secretion of milk in the puerperal state, in cases of threatened abscess. For this purpose about two or three handfuls of the flowers are bruised and applied to the breasts and renewed once or twice a day. The secretion is sometimes arrested in twenty-four hours, though generally a longer time is required. Mr. Wood speaks of this practice as being well known in Madras.

The wild single variety, called *Vikhmogra* or *Vishmogra*, (*Rheede vi.*, 56,) is used as an emmenagogue.

The juice of the leaves of **J. arborescens**, *Roxb.*, is used with pepper, garlic and other stimulants as an emetic in obstruction of the bronchial tubes by viscid phlegm. Seven leaves will furnish sufficient juice for a dose. For young children the juice of half a leaf and of four leaves of Agásta (*Sesbania grandiflora*) may be mixed with two grains of black pepper and two grains of dried borax and given in honey.

The bark and leaves of the following plants, belonging to this Order, are used by the hill villagers in the Madura District, in the preparation of Sago-toddy.

They are believed to assist and regulate the process of fermentation, but do not directly impart any intoxicating properties to the liquor.

Olea glandulifera, *Wall. Wight. Ic., t.* 1238; *Bedd. Fl. Sylv.* t. 238. Kadaly (*Tam.*).

The bark, which is externally greyish with whitish specks, internally brown and about $\frac{1}{6}$ of an inch in thickness, breaking with a close granular facture, contains a bitter glucoside and quercetin. The water extract amounts to 14·5, spirit extract 12·9, and ash 8·2 per cent.

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Jasminum flexile, *Vahl., Wight Ic. t.* 1253; *Burm. Zeyl. t.* 58, *f.* 1. Mullu-gundu (*Tam.*).

A woody climber, stems about one inch in diameter, very woody and knotted, covered with a light yellowish brown, papery bark, exfoliating on the surface, contains a bitter glucoside and colouring matter. The water extract amounts to 9·6, spirit extract 6·6, and ash 7·9 per cent.

Ligustrum Roxburghii, *Clarke, Wight Ic.* 1242. Pungala (*Tam.*).

The bark is of a russet brown colour, and ¼ of an inch thick; fracture close, showing thick white fibres running through the brown inner and middle layers. The leaves are ovate or ovate lanceolate; dark green, smooth, entire, lighter on the under surface. Its chemical composition is similar to that of *J. flexile.*

SALVADORACEÆ.

SALVADORA PERSICA, *Garcin.*

Fig.—*Roxb. Cor. Pl. i., t.* 26; *Bedd. Fl. Sylv., t.* 247; *Wight Ill. ii., t.* 181.

SALVADORA OLEOIDES, *Dcne.*

Fig.—*Jacq. Voy. Bot., t.* 144; *Brand. For. Fl., t.* 39; *Wight Ic., t.* 1621.

Hab.—The drier parts of India. The leaves, fruit, bark and oil.

Vernacular.—Pilu, Jhál (*Hind.*), Pilu (*Beng., Guz.*), Kakhan (*Mar.*), Kalarva, Kárkol, Ughai-puttai (*Tam.*), Varagogu (*Tel.*).

History, Uses, &c.—The two species of Salvadora grow upon the sea coast of Arabia, Persia and Western India, as well as in the arid districts of the interior. They are the Pilu of Sanskrit writers, and in the Nighantas bear the synonyms of Sahasrá, Karambha-priya, Tatphala, etc. The

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Hindus consider the fruit to be hot, digestive, lithontriptic, fattening and light; and to be beneficial in enlarged spleen, rheumatism, tumours and lithiasis; it is also thought to have alchemic or alterative properties. In Marwar and other parts of Northern India the berries of *S. oleoides* and *S. persica* are largely collected and dried in the sun as an article of diet. When dry they resemble grape currants both in appearance and taste. From the seeds an oil is expressed, which is used as a stimulating application in painful rheumatic affections and after childbirth. The leaves of these trees heated and tied up in a cloth with those of *Vitex trifolia* are a favorite domestic remedy for rheumatic pains.

The Arabs call the Salvadoras Arák and the Persians Darakht-i-miswák, "tooth-brush tree," short pieces of the root, about the size of goosequill, being used to clean the teeth. On the coast of Persia bordering the Persian Gulf these shrubs are called Chúch, and are depastured by camels and buffaloes. They are said to render the milk very rich and thick. This property of the plant as a fodder is also known in India. The author of the *Makhzan-el-Adwiya* describes the fruit as de-obstruent, carminative and diuretic, and remarks that a poultice of the leaves, which have similar properties, is used to relieve the pain caused by tumours, piles, etc.

Forskahl (*Ægypt–Arab.*, p. 32) has the following notice of Salvadora:—"In magno est pretio; fructus (*Kabath*) maturus edulis; folia contusa imponuntur tumoribus naṛam (ورم) dictis et bubonibus; sed vis antitoxica adeo famosa, ut carmine quoque celebretur." Kabáth is the Arabic name for the ripe fruit, when unripe it is called بریر (barir).

Ainslie gives *Ooghai-puttai* as the Tamil name of *S. persica*, and says, "the bark, which is a little warm and somewhat acrid, is recommended by the Hindu doctors, in decoction, in cases of low fever, and as a tonic and stimulant in amenorrhœa. The bark of the root when fresh acts as a vesicatory." (*Mat. Ind.* ii., p. 266). In the *Pharmacopœia of India*, we are told that Dr. Irvine employed the root-bark successfully as a vesi-

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cant. In Dr. Imlach's Report on Snake-bites in Sind (*Bomb. Med. and. Phys. Trans. New Ser.*, iii., p. 80,) several cases are mentioned in the tabular record, in which Pilu seeds were administered internally, with good effect. They are also said to be a favorite purgative.

Royle considers *S. persica* to be the mustard tree of the New Testament, and says that the Syrian Arabs call it Khardal, *i. e.* "mustard."

Description.—*S. persica* and *S. oleoides* are small trees or shrubs with a crooked trunk, seldom more than one foot in diameter; bark scabrous and cracked, whitish; branches numerous, spreading; their extremities pendulous, like those of the weeping willow; leaves opposite, petioled, oval or oblong, veinless, shining on both sides, fleshy, from 1 to 2 inches long, and one inch broad; flowers minute, greenish yellow, in terminal panicles from the exterior axils; berry in *S. persica* small, smooth, red, juicy; in *S. oleoides* it is larger and yellow. The solitary seeds have a strong aromatic smell, and taste like garden cress. The oil of *S. oleoides* is of the consistence of butter, of a bright green colour, and pungent odour. That sold in the shops is usually adulterated, and is of a greenish yellow colour, and of greater consistency than the genuine article.

The root-bark when fresh is of a light brown colour and nearly smooth, studded pretty thickly with scabrous corky warts, either single or arranged in transversely extended patches. The substance and inner surface of the bark is white and soft; fracture short; odour like cress; taste warm and pungent.

Microscopic structure.—The epidermis is formed of several rows of brick-shaped cells containing brown and green colouring matter; within this the cells of the parenchyma are brick-shaped and arranged in rows for some distance inward, afterwards the arrangement becomes more irregular, and the cells are loaded with starch, a few oil globules, and raphides; towards the inner part of the bark are a few large yellow stone cells. The wood is porous; the vascular system composed of large, very

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fine dotted vessels. The medullary rays are remarkable for the number of large raphides contained in their cells.

Chemical composition.—The air-dried root bark of *S. Persica* was reduced to powder and extracted with 80 per cent. alcohol, the greater part of the alcohol recovered by distillation, and the last traces removed by spontaneous evaporation. The resulting extract was mixed with water, acidulated with sulphuric acid and agitated with ether. The ether extract contained some resin and colouring matter. During agitation with ether, brown flocks separated, which were subsequently collected by filtration. These flocks were partly soluble in alkalies, the alkaline solution giving a precipitate on the addition of acids: the alcoholic solution was neutral, and gave no reaction with ferric salts.

The original acid aqueous solution was rendered alkaline and reagitated with ether, and the ether driven off by a current of cold air. During evaporation there was a marked odour of *trimethylamine*. The ethereal extract consisted of a soft yellow resin-like substance, and a small amount of clear watery fluid. The reaction was strongly alkaline; a few drops applied to the skin caused a painless redness in about 10 minutes; no vesication ensued. A glass plate was moistened with dilute sulphuric acid and placed over the capsule containing the extract. After some time an odourless, crystalline deposit was observed, which, on the addition of an alkali, afforded the odour of trimethylamine. The remainder of the ethereal extract was heated for some hours in the water bath to 100° C. The residue was partly soluble in acids, and afforded all the reactions of an alkaloid. This residue was without any action when applied locally to the skin. After agitation with ether, the still alkaline original liquid was agitated with chloroform, which separated a further quantity of trimethylamine, and traces of an alkaloid. We propose calling the alkaloid *Salvadorine*.

The air-dried root-bark lost 13·76 per cent. when heated to 100° C., the ash amounted to 27·06 per cent., and was

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remarkable for the large amount of chlorine present. No manganese was detected. The juice of the fresh bark and leaves had an acid reaction.

It appears to us highly probable that the stimulating effects of the fresh bark, when applied locally, are due to the presence of trimethylamine, a part of which no doubt exists in it in a free state, and the remainder as a salt, most likely as the chloride. The rapid and painless manner in which the dilute aqueous solution of trimethylamine produces redness of the skin, might perhaps be utilized, if the extremely offensive odour of the drug were not a bar. Trimethylamine is stated to act in a similar manner to aqueous ammonia locally, but it appears to us that trimethylamine is more active.

The fleshy portion of the dried fruit of *S. oleoides* has a taste similar to that of grape currants, and contains a large amount of sugar, which reduces an alkaline copper solution on boiling. The seeds contain a white fat with a melting point of 39 to 40° C (uncorr.). The alcoholic solution was neutral to litmus paper. We also isolated an alkaloid, soluble in ether and amylic alcohol, and giving very marked precipitates with alkaloidal reagents, but no special colour reactions. It also afforded marked precipitates with chromate and bichromate of potassium from its solution in H^2So^4. The taste was somewhat bitter and harsh. We are not in a position to state whether this principle differs or not from the one we detected in the root bark. A yellow colouring principle is also present in the seeds, which gives a deep bright yellow coloration with alkalies.

AZIMA TETRACANTHA, *Lam.*

Fig.—*Wight Ill. ii., t.* 152; *Gärtn. Fruct. t.* 225.

Hab.—Deccan Peninsula and Ceylon. The leaves, root, and juice.

Vernacular.—Kanta-gúrkamai (*Hind.*), Trikant a-jati (*Beng.*), Sukkapát (*Mar.*), Sungam-cheddi (*Tam.*), Tella-upi (*Tel.*).

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History, Uses, &c.—The leaves, root, and milky juice are bitter, and are used medicinally by the Hindus. Dr. P. S. Mootooswamy (*Ind. Med. Gazette*, October, 1889,) states that the leaves are considered stimulant, and are given to puerperal women immediately after confinement. They are administered in the following manner by the villagers:—The leaves with an equal quantity of Neem leaves, and a little powdered brick, are finely ground and given twice a day for the first two days, no food being allowed. For the next six days the woman gets a little boiled rice and pepper water once a day, and is allowed to drink a little warm water after the meal; she is not allowed to sleep after her food during the day, and if thirsty must quench her thirst by eating betel-leaves and areca nut. From the seventh day she gets her ordinary food. It is also the practise among the rural classes to give 2 to 4 ounces of Neem oil soon after delivery, with a little roasted asafœtida, and the woman is made to take daily for a month from the morning of the third or fourth day a bolus of a stimulating confection, called *Naday-cayam* in Tamil, which is supposed to keep off cold from the system. (This practice is general amongst the country people in most parts of India.)

The leaves are also administered with food as a remedy for rheumatism, and their juice to relieve cough.

The root is considered to have the same properties as the leaves, and to be also diuretic; it is given in dropsy along with other drugs. Dr. Mootooswamy gives the following formula as much used by native doctors:—Take of the root bark ℥x, *Tribulus terrestris* fruit, root of *Trianthema monogyna* and *Cephalandra indica* ā ʒi, Beleric and chebulic myrobalans ā ʒss, Iron dross ℥x, Goat's urine ℥viii, Water four sers. Make a decoction and keep it for several days in the oven. Dose 2 to 3 ounces twice a day in as much water.

A decoction of the root, leaves and bark with an equal quantity of *Acorus Calamus*, ginger, ajowan seeds and salt is recommended as a remedy for chronic diarrhœa, and 1 to 1½ ounces of the juice obtained from the root bark, with

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three ounces of goat's milk, twice a day as a diuretic in dropsy.

Description.—Stem scarcely any, but branches innumerable, opposite, spreading in all directions, forming a close impenetrable bush, something like the Furze; young branches four-sided. Thorns axillary, four-fold, spreading, very sharp, from 1 to 2 inches long. Leaves opposite, short-petioled, reflexed, oval, acute. Male flowers axillary, numerous, female axillary, solitary, sessile, between the two thorns. Berry globular, of the size of a pea, when ripe white, succulent, edible. Seeds two. The plant is in flower and fruit the greater part of the year.

APOCYNACEÆ.

ALSTONIA SCHOLARIS, *Br.*

Fig.—*Wight Ic., t.* 422; *Bedd. For., Fl., t.* 242; *Rheede Hort. Mal. i., t.* 45; *Bentl. and Trim. t.* 173.

Hab.—Drier forests of India. The bark and leaves.

Vernacular.—Chhatián, Dátyúni (*Hind.*), Chhátin (*Beng.*), Sátvin (*Mar.*), Ezhilaip-pálai (*Tam.*), Edakula-pala, Palagaruda (*Tel.*), Janthalla (*Can.*).

History, Uses, &c.—The tree is called in Sanskrit Saptaparna, Sapta-chhada, Guchha-pushpa, Vrihat-tvak and Vishala-tvak, "having large or thick bark." Hindu physicians describe it as tonic, alterative, and useful in fever, skin diseases, and dyspepsia. Susruta gives the following formula for use in catarrhal dyspepsia:—"Take of the bark of *Alstonia*, stems of *Tinospora cordifolia*, bark of *Azadirachta indica*, and the bark of *Betula Bhojpatra*, equal parts, in all two tolas (320 grains), and prepare a decoction in the usual way." It also enters into the composition of several prescriptions for boils and other diseases of the skin. The specific name *scholaris* has been given to this tree from the fact of its planks, covered

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with a layer of sand, being used as school-boards on which children trace their letters as in the Lancastrian system. The natives of Western India have a superstitious fear of it, and say that it assembles all the trees of the forest once a year to pay homage. (*Graham.*)

Rheede in 1678 and Rumphius in 1741 described and figured the tree and noticed the medicinal use of the bark by the natives along with salt and pepper in febrile dyspepsia, and as a local application to ulcers and rheumatic joints. Rumphius's experience is, that the bark is useful in catarrhal dyspepsia and in the febrile state consequent upon that affection, and also for enlarged spleen. He says: "Of its value in catarrhal dyspepsia I can speak from experience; the dose should be 15 grains taken at bedtime in powder or decoction." Nimmo in 1839 called attention to the bark as a powerful tonic, and suggested its use as an antiperiodic. Dr. Gibson in 1853 contributed a short, but interesting, account of the drug to the *Pharmaceutical Journal* (xii., p. 422). Alstonia bark is official in the *Pharmacopœia of India*, and is described as an astringent tonic, anthelmintic, and antiperiodic. In the Concan the juice of the fresh bark with milk is administered in leprosy, and is also prescribed for dyspepsia and as an anthelmintic; and the juice of the leaves with that of fresh ginger root or zedoary is administered to women after confinement. One of us has found the tincture of the bark to act in certain cases as a very powerful galactagogue: in one case the use of the drug was purposely discontinued at intervals, and on each occasion the flow of milk was found to fail.

In 1874 Gruppe, an apothecary of Manilla, obtained from the bark a substance which he named *ditain*. In the report on the Centennial Exhibition presented to the American Pharmaceutical Association (Transactions 1877), the following account of this substance and of the use of the drug in Manilla is given:—"*Echites scholaris* (*Alstonia scholaris*, Brown,) grows wild abundantly in the central provinces of the island of Luzon, where it has long been known and esteemed by the natives under the name of 'Dita,' as a most efficient tonic and febri-

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fuge. The people having been in the habit of using it from time immemorial in decoction against malignant, intermittent, and remittent fevers with the happiest result, the attention of our leading physicians was excited, and the active principle ditain has now become a staple article, and ranks equal in therapeutical efficiency with the best imported sulphate of quinine. Numberless instances of private and hospital practice, carried out by our best physicians, have demonstrated this fact. Equal doses of ditain and of standard quinine sulphate have had the same medicinal effects; besides leaving none of the disagreeable secondary symptoms, such as deafness, sleeplessness, and feverish excitement, which are the usual concomitants of large quinine doses, ditain attains its effects swiftly, surely, and infallibly.

We use ditain generally internally in quantities of half a drachm daily for children, and double the dose for adults, due allowance being made, of course, for age, sex, temperament, &c. We derive very beneficial effects from its use, too, under the form of poultices. Powdered dita bark, cornflour, each half a pound; hot water sufficient to make a paste. Spread on linen and apply under the armpits, and on the wrists and ankles, taking care to renew when nearly dry, and provided the desired effects should not have been obtained. The results arrived at by ditain in our Manilla hospitals and private practice are simply marvellous. In our military hospital and penitentiary practice, ditain has perfectly superseded quinine, and it is now being employed with most satisfactory results in the Island of Mindanao, where malignant fevers are prevalent."

Description.—The drug consists of irregular fragments of bark, ⅛ to ½ an inch thick, easily breaking with a short coarse fracture. The external layer is very uneven and much fissured, dark grey or brownish, sometimes with black spots, it readily separates when handled. The interior substance and inner surface (liber) is of a bright buff. A transverse section shows the liber to be finely marked by numerous small medullary rays. The bark has no particular odour; when chewed it

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communicates gradually to the palate a slightly bitter but not disagreeable taste.

Microscopic structure.—The cortical tissue is covered with a thin suberous coat, the middle layer of the bark is built up of a thin-walled parenchyme, through which enormous, hard, thick-walled cells are scattered in great numbers, and are visible to the naked eye, as they form large irregular groups of a bright yellow colour. Towards the inner part these stone-cells disappear, the tissue being traversed by undulated medullary rays, loaded with very small starch grains; many of the other parenchymatous cells of the liber contain crystals of calcium oxalate. The longitudinal section of the liber exhibits large but not very numerous laticiferous vessels, as elongated simple cells with perforated tranverse walls (sieve-cells) containing a brownish mass, the concrete milk-juice with which all parts of the tree abound.

Chemical composition.—In 1875, Jobst and Hesse exhausted the powdered bark with petroleum ether, and then extracted, by boiling alcohol, the salt of an alkaloid, which they called *Ditamine.* After the evaporation of the alcohol, it is precipitated by carbonate of sodium and dissolved by ether, from which it is removed by shaking it with acetic acid. Ditamine as again isolated from the acetate forms an amorphous and somewhat crystalline, bitterish powder of decidedly alkaline character; the bark yields about 0·02 per cent.

From the substances extracted by means of petroleum ether, as above stated, Jobst and Hesse further isolated (1) Echicaoutchin, $C^{25}H^{40}O^{2}$, an amorphous yellow mass; (2) Echicerin, $C^{30}H^{48}O^{2}$, forming acicular crystals, melting at 157° C.; (3) Echitin, $C^{32}H^{52}O^{2}$, crystallized scales, melting at 170°; (4) Echitein, $C^{42}H^{70}O^{2}$, which forms rhombic prisms, melting at 195°; (5) Echiretin, $C^{35}H^{56}O^{2}$, an amorphous substance, melting at 52° C.

Echicaoutchin may be written thus: $(C^{5}H^{8})^{5}O^{2}$, echicerin $(C^{5}H^{8})^{6}O^{2}$, echiretin $(C^{5}H^{8})^{7}O^{2}$; these formulæ at once indicate how nearly the three substances are allied. They are

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probably constituents of the milky juice of the tree. (*Pharmacographia, 2nd Ed., p.* 422.)

Hesse has since separated from Dita bark two other bases, *Echitamine* and *Echitenine.* He now reports that *Ditamine* exists in the bark in the proportion of 0·04 per cent. It is readily soluble in dilute acids, and differs from the alkaloids associated with it in being precipitated from its acid solution, by ammonia. Its formula deduced from the analysis of its platinochloride, is $C^{16}H^{19}NO^{2}$.

Echitamine is obtained from the liquor from which the ditamine has been extracted. On neutralizing this liquor, concentrating it by evaporation, and then adding hydrochloric acid and sodium chloride, impure echitamine hydrochloride is precipitated. The base isolated from this precipitate, and then purified, crystallizes in thick vitreous prisms, answering to the formula $C^{22}H^{28}N^{2}O^{4}+4H^{2}O$. When dried in vacuo these part with three molecules of water, leaving a strong base of the formula $C^{22}H^{28}N^{2}O^{4}+H^{2}O$, or $C^{22}H^{30}N^{2}O^{5}$, which the author calls echitamine hydrate, or echit-ammonium hydroxide. If in drying the heat be raised to and maintained at 150° C., another molecule of water is given off; but the anhydrous echitamine thus left is a much weaker base, and is reconverted into the original alkaloid by dissolving it in hydrochloric acid, and decomposing the hydrochloride. In consequence of the decided loss of basic properties accompanying the elimination of the last molecule of water, the author prefers to regard the monohydrated base as the normal form. The latter is a powerful alkaloid; it neutralizes acids perfectly, and yields well-defined crystallizable salts.

Echitenine.—This base is prepared from the mother liquors of echitamine hydrochloride, by precipitating with mercuric chloride, decomposing the precipitate with sulphuretted hydrogen, and then shaking with chloroform. It exists in the bark to the extent of only 0·01 per cent. Its composition corresponds to the formula $C^{20}H^{27}NO^{4}$. It is markedly bitter, of a brownish colour, and fuses above 120° C. With

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strong sulphuric acid it forms a reddish violet, and with nitric acid a purple solution, the latter of which changes to green and ultimately to yellow. Its salts are amorphous. In the author's opinion all these alkaloids belong to one series:—

Ditamine ....$C^{16}H^{19}NO^{2}$
? ....$C^{18}H^{25}NO^{3}$
Echitenine ....$C^{20}H^{27}NO^{4}$
Echitamine Hydrate (Echit-ammonium Hydroxide) ....$C^{22}H^{30}N^{2}O^{5}$

(*Liebig's Annalen, cciii.*, 144) *in Year-Book of Pharmacy for* 1881.)

Commerce.—The bark is not an article of commerce in India.

Rhazya stricta, *Decaisne. in Jacq. Voy. Bot., t.* 111.

Vernacular.—Sewar (*Sind*).

This plant is widely distributed through Western Asia, from Yemen in Arabia, to the North-West Provinces of India. Its leaves, which are very bitter, are sold in the bazars in Sind, the natives using them in the preparation of cooling bitter infusions. *R. stricta* is a stiff-growing plant with erect stems 2 to 3 feet high, and upright thickish smooth leaves placed rather close together on the stem. Dr. Stocks describes the infusion as a good and peculiar bitter tonic, and recommends it for trial.

HOLARRHENA ANTIDYSENTERICA, *Wall.*

Fig.—*Brand. For. Fl., t.* 40; *Wight Ic., t.* 1297; *Rheede Hort. Mal.* i., *t.* 47. Conessi or Tellicherry Bark (*Eng.*), Écorce de Codagapala (*Fr.*).

Hab.—Throughout the drier forests of India. The bark.

Vernacular Kura, Kaureya (*Hind.*), Kurchi (*Beng.*). Kuda, Pándhara-kuda (*Mar.*), Kuda, Doula-kuda (*Guz.*), Kulap-pálai (*Tam.*), Amkudu (*Tel.*), Kodamuraka, Kodasiga (*Can.*).

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The seeds: Karwa-indarjau (*Hind.*), Tita-indarjau (*Beng.*), Kulappalai-virai (*Tam.*), Amkudu-vittulu (*Tel.*), Kadu-indarjau (*Mar.*), Kadvo indarjau (*Guz.*), Kodu-murakan-bija (*Can.*).

History, Uses, &c.—The Sanskrit names for this useful tree are very numerous, the best known are Kutaja and Kalinga, amongst others we may mention Girimallika, Vatsaka "cow tree," Sakra sakhin "Indra's tree," and Sakrásana "Indra's food." The tree is fabled to have sprung from the drops of amrita which fell on the ground from the bodies of Rama's monkeys, which were restored to life by Indra. The seeds are called in Sanskrit Indrayava, Bhadrayava, Vatsakavija, or Sakravija, "Indra's seed." The bark is one of the most important articles in the Hindu Materia Medica, and is described in the Nighantás as bitter, astringent, cold and digestive; a remedy for piles, dysentery, bile, leprosy and phlegmatic humours. Susruta says it is expectorant, an antidote to poisons, cures dysuria, urinary and skin diseases, checks nausea and vomiting, removes pruritus, improves the condition of bad ulcers, relieves pains of the stomach, and checks the derangement of the three humours, *viz.*, phlegm, air and bile. The seeds are considered to be astringent, febrifuge and anthelmintic. Both bark and seeds are usually combined by Hindu physicians with a number of other medicines which are principally astringents, bitters and aromatics. As examples of such preparations we may mention the *Kutajaleha* or confection, and the *Patháдya churna* or compound powder of Chakradatta. In the *Pradaráni lauha* the drug is combined with iron, but perhaps the most popular preparation is the *Kutajárishta* or Kutaja wine of Sarangadhara, which is made in the following manner:—Take of fresh root bark, 12½ seers, raisins, 6¼ seers, flowers of *Bassia latifolia* and bark of *Gmelina arborea* of each 80 tolas; boil them together in 256 seers of water, till reduced to 64 seers, and strain. Then add flowers of *Woodfordia floribunda* 2½ seers; treacle 12½ seers, and let the mixture ferment for a month in a cool place (it is usually buried under the ground). Draw off and bottle. This preparation has an agreeable flavour, is not bitter, and is an excellent

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remedy in chronic dysentery and diarrhœa. Plasters and oils, containing Conessi bark combined with astringents and aromatics, are also used by the Hindus. They are applied over the part of the abdomen which is most painful.

Arabic and Persian writers describe the seeds under the name of Lisán-el-asafír-el-murr, and Zabán-i-gungishk-i-talk (bitter sparrow's tongue); they consider them to be carminative and astringent, and prescribe them in chronic chest affections, such as asthma, also in colic and diuresis; besides this they attribute lithontriptic, tonic and aphrodisiac properties to them, and combined with honey and saffron make them into pessaries which are supposed to favour conception. We may mention incidentally that the use of medicated pessaries for this purpose is a common practice in India.* They are also used after delivery. According to the Makhzan, the bark is the Tiwaj (tvac?) of Persian writers, which the author of the *Tuhfat* identifies with Talisfar, by some supposed to be the Indian bark used in dysentery by the Greek physicians under the name of μάκερ.

The Portuguese physicians, Garcia and Christopher a Costa, describe the drug under the names of Coru, Curo, Cura and Corte de pala. Rheede, who calls the tree Codaga-pala, states that the bark is applied as a *lép* (plaster) in rheumatism, and that a hot decoction of it is used in toothache, and in the cure of bowel affections. Ainslie mentions the bark as having been lately admitted into the British Materia Medica, under the name of Conessi bark.

Conessi bark, also known as Codaga pala, Corte de pala, and Tellicherry bark, enjoyed for a time considerable repute in Europe. It has however fallen into disrepute, principally, according to Sir Walter Elliot, who regards it as one of the most valuable medicinal products of India, from the comparatively inert bark of *W. tinctoria* having been confounded with it. Favourable reports of its use as a remedy in dysentery will be found in the *Pharmacopœia of India*. For ad-

* Similar pessaries were used by the Greeks and Romans.

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ministration Mr. O. C. Dutt prefers a watery extract of the root bark, of which the average dose is about three grains in combination with half a grain or more of opium.

Other European physicians have preferred the powdered bark, or a decoction made with 2 oz. of the bark to 2 pints of water, to be boiled down to one pint. The impure alkaloid (wrightine) is bitter, and has been used with some success as an antiperiodic, and in the treatment of dysentery occurring in aged persons and infants. It is sold by druggists in Calcutta.

For an exhaustive analysis of the botanical confusion which has arisen in connection with this plant and the various species of Wrightia, we would refer our readers to an article by M. R. Blondel (*Nouveaux Remédes*, Sept. 24, 1887,) in which the botanical history and structure of *Holarrhena antidysenterica* is fully discussed and illustrated.

Description.—Three Apocynaceous plants are frequently called *Kura, Koda* or *Kuda* in the Indian vernaculars; *Holarrhena antidysenterica*, *Wrightia tomentosa*, and *Wrightia tinctoria*. They may be distinguished most readily by an examination of the follicles and seeds. *H. antidysenterica* has the pair of follicles separate, *W. tomentosa* has them connate, separating when quite ripe, and *W. tinctoria* has follicles connected at the apex only. In Holarrhena the seeds have a tuft of hairs on the end most remote from the foot-stalk, whilst in the Wrightias the tuft is on the end next the foot-stalk.

The young bark of Holarrhena is grey and nearly smooth; on the older branches it is externally of a brown colour, and scarred from the exfoliation of portions of the suber; internally it is of a cinnamon colour, and the cambium layer when present smooth and nearly white. The root bark resembles that of the older stems, but is of a deeper and more rusty brown colour.

The seeds resemble oats, are very bitter, and are contained in long follicles about the thickness of a quill. They are of a

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yellowish brown colour, about 2 centimetres long and 2 to 3 millimetres thick; at one end of the seeds is a kind of shallow neck, to the sides of which was attached the tuft of hairs. One side of the seed is grooved, and in this groove may be seen the raphé. The outer envelope of the seed is thin and papery, and within it is a thin white layer of albumen. The embryo consists of a conical radicle and two foliaceous convoluted cotyledons.

Microscopic structure.—A section of the bark from the larger branches is remarkable for several layers of rhytidoma, the inner of which is in contact with the cambium; this structure gives rise to exfoliations of portions of the outer layer of the bark. Simple and branched laticiferous vessels are to be seen, and a few groups of stony cells. The cells of the parenchyma are filled with starch granules and contain red colouring matter. Externally there is a thin layer of suber. In the young bark the rhytidoma is not developed, consequently there is no exfoliation.

Chemical composition.—The bark and seeds contain a basic substance (*Wrightine*), to prepare which the pulverised seeds are treated with carbon bisulphide in a displacement apparatus to remove a fat oil, then dried and exhausted with hot alcohol; the extract freed from alcohol by distillation, is digested with a small quantity of dilute hydrochloric acid, and the evaporated filtrate is mixed with ammonia or sodic carbonate, which throws down a copious flocculent precipitate, consisting of the impure base.

Wrightine after washing with cold water forms an amorphous powder, insoluble in ether and in carbonic disulphide, soluble in water and alcohol, and especially in dilute acids, with which it forms uncrystallisable salts having like the base itself a persistent bitter taste. The acetic acid solution is precipitated by tannic acid; the hydrochloric acid solution gives flocculent precipitates with platinic, auric, and mercuric chlorides. (*Stenhouse, Phar. Jour.* (2), V., 493.) R. Haines (*Ibid.*, VI., 432) states that he obtained the same base from Conessi

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bark in 1858, and gave a short description of it in the *Transactions of the Medical and Physical Society of Bombay* (New Series, IV., 38). He proposed to call it *Conessine*, and calculated, from the analysis of the free base, and of the platinum salt, the formula $C^{25}H^{22}NO$. The seeds have recently been again investigated by Herr Warnecke (*Berichte*, XIX., 60), who has obtained from them a crystalline alkaloid by exhausting them with ether containing a little hydrochloric acid, digesting the extract with water and precipitating with ammonia, washing the yellow flocculent precipitate with water, and then after drying it over sulphuric acid dissolving it in petroleum spirit and evaporating. The pure alkaloid is described as occurring in delicate colourless anhydrous needles, having a bitter taste, becoming yellow at 60° to 70° C., and melting at 122° C. The alkaloid readily forms salts with acids, the hydrochlorate being crystalline. It is difficultly soluble in water, but freely soluble in alcohol, ether, chloroform, petroleum spirit, benzol, amyl alcohol, and carbon bisulphide. An analysis gave figures corresponding with the formula $C^{11}H^{18}N$. Herr Warnecke therefore claims that this base, for which he prefers the name "Wrightine" is the first discovered solid non-oxygenated alkaloid occurring in nature; in this, however, he is hardly correct, since the formula $C^{46}H^{20}N^{4}$ was attributed in 1861 to a base isolated by Rieth from the bark of *Arariba rubra* (*Annalen*, CXX., 247), which was also obtained crystalline.

Rather curiously, but simultaneously with the publication of the above-mentioned communication, another appeared by Messrs. Polstorff and Schirmer (*Berichte*, XIX., 78), which described the results of the chemical examination of a bark forwarded from Tropical Africa by German missionaries as a remedy against dysentery, and referred to *Holarrhena africana*, DC. They report that they have isolated from this bark minute proportions (one-tenth per cent.) of an alkaloid that they consider to be identical with that separated by Professor Haines from East Indian conessi bark; and they attribute to it characters closely resembling those described by Herr Warnecke as

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pertaining to the alkaloid obtained by him from *Wrightia antidysenterica* seeds. Like that alkaloid also, though crystallizable, it contains no oxygen, the formula by which it is represented being $C^{12}H^{20}N$ or differing by CH^2 from the formula given by Herr Warnecke for his alkaloid; but Messrs. Polstorff and Schirmer think their formula $C^{12}H^{20}N$ is fairly comparable with that of Professor Haines for conessine from East India Conessi bark, $C^{25}H^{22}NO$ (old notation), since the free base has the peculiarity (also shared by Aribine) of crystallizing with a molecule of water; and they think that his combustion was probably made with imperfectly dried alkaloid. It will be observed that Professor Haines and Messrs. Polstorff and Schirmer operated upon the bark of the respective plants, whilst Herr Warnecke used the seeds. So that at present there is some doubt whether both barks yield an identical alkaloid, differing in composition from that from conessi seeds by CH^2, or whether it is the alkaloid from the East Indian and African plants that differ, but are homologous. Messrs. Polstorff and Schirmer have prepared and described several salts of their alkaloid. It may be added that there is a remark in the Appendix to the Indian Pharmacopœia to the effect that probably *Holarrhena* (*Wrightia*) *antidysenterica, H. Codaga, H. pubescens* and *H. malaccensis*, are only varieties of one species, and are endowed with similar, if not identical, medicinal properties. It appears desirable, therefore, that the investigation should be extended to the bark and seeds of those plants. (*Pharm. Journ., Feb.* 27, 1886.)

Commerce.—The bark and seeds are both articles of local commerce. Value, bark, Rs. 1½ per maund of 37½ lbs.; seeds, Rs. 25 per maund.

Wrightia tinctoria, *Br.*, *Wight Ic.*, t. 444; *Bot. Reg.* t. 933, a native of Central India, the Western Peninsula and Burma, which has already been mentioned in connection with the last article as a kind of *Kura,* affords a bitter bark which is frequently substituted for true Conessi bark; its seeds also are an article of commerce under the name of *sweet indarjau.*

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This shrub is often cultivated in gardens on account of its fragrant, white, jasmine-like flowers, which are offered in the Hindu temples. It would appear to have been confounded by Garcia d'Orta with Holarrhena, as he states (*Coll.* 27) that the flowers of Coru smell like Honeysuckle, whereas those of Holarrhena are odourless. The leaves of this plant, which turn black when dry, afford a kind of indigo called in Mysore *Pala Indigo.* An account of the preparation of this dye appears in Buchanan's "Journey through Mysore, &c.," 1, 473. The coagulated milky juice forms a kind of caoutchouc; the wood is valued by turners, who call it Dudhi, "milk wood."

The bark may be distinguished from true Conessi bark by its darker colour, and by its not exfoliating in patches (absence of rhytidoma); the seeds by their want of bitterness. The bark is used as a tonic and the seeds as an aphrodisiac; both are articles of commerce, the former being more frequently met with in the shops than true Conessi bark. The seeds are sold at about Rs. 4 per maund of 37½ lbs.

NERIUM ODORUM, *Soland.*

Fig.—*Bot. Mag.,* 1799, 2032; *Bot. Reg., t.* 74; *Rheede Hort. Mal. iv., t.* 1, 2. Oleander (*Eng.*), Laurier Rose (*Fr.*).

Hab.—W. Himalaya, Central India, Sind. Cultivated all over India. The root.

Vernacular.—Kaner (*Hind., Guz., Mar.*), Karabi, Kaner (*Beng.*), Alari (*Tam., Mal.*), Gannèru (*Tel.*), Kanigila (*Can.*).

History, Uses, &c.—In Sanskrit medical works two varieties of Karavira are mentioned, namely, Svetapushpa, "white-flowered"; and Raktapushpa, "red-flowered." Other well known Sanskrit names for the Oleander are Asvamáraka "horse-killer," and Pratihasa "laughing." In the Nighantas both kinds are described as hot and poisonous; they are said to be of use as an external application to swellings, leprosy and skin diseases such as itch. The flowers of the red and white Oleander are much used by the Hindus in religious ceremonies.

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De Gubernatis states that the *N. Oleander* is called in Italy *Ammazza cavallo* or *Ammazza l'asino*, and remarks that this accounts for the dread of its presence shown by the ass of Lucian and Apuleius. (*Myth. des Plant.* ii., 259.)

For external application the Hindus make a strong decoction of the root and boil it down with oil and cow's urine until the water has been driven off, other drugs are usually added, such as Plumbago root, Embelia seeds, &c.

The root of Oleander beaten into a paste with water is recommended by Sarangadhara to be applied to chancres and ulcers on the penis. According to Chakradatta the fresh juice of the young leaves is dropped into the eyes in ophthalmia with copious lachrymation. In Arabic and Persian works the plant will generally be found described under the name of Difli; other names are Sum-el-Himár and Kharzahrah, which both signify Asses'-bane; it is identified with the Nerium of the Greeks.* The Mahometan physicians describe it as a most powerful resolvent and attenuant, only to be used externally; taken internally it acts as a poison upon men and animals. A decoction of the leaves is recommended to reduce swellings, and an oil prepared from the root bark in skin diseases of a scaly nature and in leprosy. Mír Muhammad Husain says that the Oleander is poisonous to insects, and that it cures itch. He also states that the leaves though poisonous to all four-footed animals are a counter-poison against serpents. The latter statement appears to be copied from Pliny. (*Hist. Nat.* 24, 2.) Ainslie informs us that the bark of the root and leaves are considered by the Vytians as powerful repellants, applied externally. The active principles of *N. odorum* are powerful heart poisons. 0·0016 grams of *Neriodorein* injected hypodermically into a large healthy frog caused in 14 minutes diminution of the heart beats from 70 to 12 per minute, followed by a temporary rise to 60; after the lapse of five minutes longer the heart ceased to beat. This cessation of the heart's action was

* Nerium Oleander, hardly different from the Indian plant. Conf. Dios. *περὶ υηρίου* iv., 80. It was also called by the Greeks and Romans Rhododaphne and Rhodadendron.

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closely followed by cessation of the respiration. According to Fraser (*Trans. Royal Soc. Ed.* xxiv.) oleander like digitalis, &c., produces at first irregularity and acceleration of the heart's action, then a diminished frequency caused by protraction of the ventricular systole, and, finally, stoppage of the contractions by cessation of the dilation of the ventricles, which remain contracted, white and perfectly empty.

Description.—Roots crooked, bark thick, soft, external surface grey, corky, on young roots the corky layer is very thin, and the interior yellow colour of the bark is seen through it, inner surface yellow. The bark when cut or wounded exudes a pale yellow latex, which is resinous and very sticky. Odour somewhat acrid. Taste acrid and bitter.

Microscopic structure.—In the bark of the roots the medullary rays are very numerous; their being loaded with yellow resinous juice makes them very conspicuous. The laticiferous vessels are numerous and generally in groups of two, three, or more. The wood is very porous, and abounds in large dotted vessels. Both bark and wood abound in starch.

Chemical composition.—Mr. H. G. Greenish has extracted from the bark of *N. odorum* two bitter principles, one soluble in chloroform and little soluble in water, to which he has given the name *Neriodorin,* and another very soluble in water and insoluble in chloroform, which he has named *Neriodorein.* Both of these substances are powerful heart-poisons. Neriodorein is an amorphous powder of a pale yellow colour, and very bitter taste, insoluble in petroleum spirit, ether, benzol, chloroform, sulphide of carbon, amylic alcohol, and acetic ether, but readily soluble in water and alcohol. It contains no nitrogen; a watery solution is neutral to test paper. Chloroform partly separates it from its watery solution in the form of an oily liquid. Chloroform and ether precipitate it from an alcoholic solution in a flocculent condition. It is soluble in glacial acetic acid, the evaporation of the solvent leaves a yellow amorphous varnish-like mass. Although the aqueous solution passes through the dialyser it has not yet been crys-

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tallised. Concentrated sulphuric acid colours it of a brownish red with a violet tinge round the edge of the mixture, gradually the mixture becomes yellow, passing to brown and green. In the presence of sugar strong sulphuric acid produces a brownish red colour passing to violet. Heated in a closed tube with 2 per cent. of hydrochloric acid for two hours, neriodorein is decomposed into a yellow resinous substance; it appears to be a glucoside. Neriodorin is a transparent yellow, varnish-like substance which cannot be pulverized even after drying over sulphuric acid under the air pump; it is very soluble in chloroform, scarcely soluble in cold water, but much more so in hot water; its watery solution is bitter. It is insoluble in petroleum spirit, benzol and bisulphide of carbon; ether only dissolves a trace. It is very soluble in alcohol, contains no nitrogen, and is uncrystallisable. In other respects it closely resembles Neriodorein. (*Phar. Jour., April 23rd, 1881.*)

Toxicology.—The leaves of *Nerium Oleander* were examined by Leukowsky (*N. J. Pharm.* 46, 397), who announced the presence in them of two alkaloids, *Oleandrine* and *Pseudocurarine.* Schmiedeberg (1883), who considers oleandrine to be a glucoside, found in the leaves two other glucosides, *Neriine* and *Neriantine*: he considers neriine to be identical with digitaleine. M. E. Picszczek (*Archiv. d. Pharm.* (3), xxviii., 352, 1890,) obtained from the bark a glucoside having the composition 62·324 per cent. Carbon, 8·066 per cent. Hydrogen, and 29·610 per cent. Oxygen, which he found to be very poisonous, having an action similar to that of strychnine: 4 cgr. proved fatal to a rabbit in three-quarters of an hour. He has named this glucoside *Rosaginine* from *Cortex Rosaginis,* the German name for oleander bark. M. Picszczek also obtained from the bark the neriine of Schmiedeberg, the composition of which he found to be 54·252 per cent. Carbon, 7·570 per cent. Hydrogen, and 38·178 per cent. Oxygen. If a portion of neriine is dissolved in strong sulphuric acid, and the vapour of bromine is made to pass over the mixture, a splendid violet-purple colour is produced. The bark was also found to contain

an essential oil of disagreeable odour, and a crystalline body, the aqueous solution of which has a fine blue fluorescence, especially after the addition of an alkali. This latter substance was only found in old bark.

Toxicology.—Chevers (*Med. Juris. for India*) refers to the toxicology of the drug at length, and states on the authority of Honigberger that the root of the hill plant is more toxic than that grown in gardens; he remarks that it is proverbial among females of the hills, when quarrelling, to bid each other go and eat the root of the *Kaner*. Ainslie also refers to its use by Hindu women when tormented by jealousy, and Broughton says that it is well known and extensively used in the Bombay Presidency as a poison, the juice from the red variety being considered the strongest and most fatal. It is also stated to be much used as a poison in the Umballa district, the root sometimes being given in coffee. Dr. Cleghorn (1868) records the history of two male adults who were found dead in the house of a prostitute. The woman confessed that she had given them the powdered root of *Kurrubee* in milk as a cure for gonorrhœa, from which they were suffering, the root being a popular remedy for venereal and skin diseases. Soon after taking the mixture, the men became sick, vomited, and complained of pain in the abdomen, writhed about the floor, and latterly became sleepy. On *post-mortem* examination the following points were noted:—

Brain—In one case engorgement of venous sinuses: puncta sanguinea abundant: otherwise apparently normal. In the other case the brain is reported as apparently healthy.

Heart.—In one case vessels on exterior surface congested, right ventricle distended with dark fluid blood; valves, &c., healthy. In the other case, two ounces of serum were found in the pericardium, and both ventricles were filled with fluid blood.

Lungs.—In one case no information recorded: in the other returned as healthy.

Stomach.—In one case congestion of vessels on posterior surface of great curvature: a well defined spot of congestion

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on posterior surface of cardiac end: a similar patch near pyloric orifice: contents grumous, fluid. In the other case, well marked spots of congestion on the anterior and posterior surfaces of peritoneal coat, covering cardiac end: mucous surfaces corresponding to these being covered with specks of stellate congestion: contents grumous, fluid.

Liver.—In one case large vessels congested, otherwise normal. In the other case, enlarged: large veins filled with blood.

Spleen.—In both cases enlarged: probably by malarious fever.

Intestines.—In one case mucous coat of small gut throughout of a dark colour: large veins distinct. Large patch of congestion on upper part of mucous surface of duodenum, surface velvetty: spots of congestion scattered through jejunum and ileum: villi well marked in upper part of jejunum: large spots of congestion in inguinal flexure. In the other case, the bowels were reported as normal, except that in parts the vessels were congested.

Kidneys.—Intensely congested in one case, healthy in the other.

Œsophagus.—In one case covered with dark-coloured mucus; in the other the upper part of fauces covered with blood.

No chemical examination of the viscera was made. In 1843, a case of fatal poisoning by the root was sent to the Chemical Examiner, Bengal, by Dr. Greig, in which the bark had been taken from the roots of a plant in the doctor's own garden, beaten to a powder, and then administered mixed with oil. It was judged that at least two or three ounces of the bark had been taken. About 1½ hour after the poison had been taken, the patient was apparently senseless and unable to answer questions: the pulse was preternaturally slow and soft but regular, with an inclination to stop: a considerable amount of the mixture was stated to have been vomited soon after it had been taken. Warm water and an emetic was administered, which induced free vomiting, and the patient was ordered to be moved about. Under this treatment he revived consider-

ably, but relapsed into insensibility some hours afterwards. The patient appears to have recovered from all urgent symptoms, but to have died suddenly on the following day after making some exertion. On *post-mortem* examination 5 hours after death, the cavities of the heart were filled with black fluid blood. The lungs were natural. The stomach contained a quantity of dark yellowish fluid, and on its internal surface, near the cardiac and pyloric orifices posteriorly were found small patches studded with red points, and one or two slight abrasions of the mucous membrane. The liver appeared somewhat distended, and the intestines and spleen are reported natural.

Mr. Broughton (*Trans. By. Med. & Phys. Soc.* for 1857-58, p. 4,) reports a case in which a slight and delicate male drank a little more than an ounce of the expressed juice, walked five yards and fell senseless. When seen in the morning, the face and eyes were flushed, head hot and perspiring, with stertorous breathing and foaming at the mouth, accompanied by violent spasmodic contractions of the muscles of the entire body: more remarkable in the upper than lower extremities, and on the left than right side. During intervals of spasm, the patient lay evenly upon his back, when an attack occurred, the superior contractions of the left side threw him over on his right, in which position he remained during the paroxysm. Insensibility continued, and the spasms returned at intervals of an hour, and were induced by attempts to rouse or move the patient: the bowels were moved involuntarily. Towards evening the spasms decreased, the face became pale, the pulse a thread, the eyes shrunk and the extremities cold: stimulants restored the circulation, but insensibility continued, and the bowels were moved involuntarily. In the evening reaction set in, the skin became hot, the pulse frequent: there was no spasms but insensibility was still complete. On the morning of the following day the patient was restored to speech and reason.

The following case was treated in the Medical College Hospital, Calcutta, and reported in the *Ind. Med. Gazette*,

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September, 1866. A male adult was brought to hospital in an apparently unconscious state, the trunk and limbs being rigid, and the jaw spasmodically closed, the pulse very feeble, and exceedingly slow, about 30. The history was to the effect that 5 hours previously more than ½ tola (45 grains) of the fresh root bark of *Sheth Kurrubee* (white oleander) rubbed up with black pepper had been taken. Within half an hour the patient began to feel giddy and very heavy, and was obliged to lie down: this was shortly followed by a general uneasy sensation and considerable restlessness. Soon afterwards fits occurred, in which the trunk and limbs were rigid and contracted, the hands clenched and thumbs flexed inwards on the palms. Profuse perspiration and a sensation of constriction round the chest also accompanied each paroxysm. In hospital the patient had no regular paroxysm, but constant muscular twitchings were observed all over the body, and continued for four or five hours after admission. The rigidity of the muscles gradually wore off, and on the morning after admission the patient declared himself quite easy save for a slight heaviness about the head. The patient stated that he had never lost consciousness, and that his mind had been quite clear. Babu K. H. Acharjee (*Ind. Med. Gaz.*, 1866,) reports the case of a boy, to whom the powdered root had been administered for intermittent fever. In three or four hours he was attacked with tetanus, and was found free from fever, quite sensible, the jaws spasmodically closed, and the muscles of the body rigid and contracted. The patient recovered. Babu D. Mookerjia draws attention to the tetanic symptoms which may occur in oleander poisoning, as evidence that the action of the poison resembles that of strychnia, and he remarks, in the case last mentioned, that all the urgent symptoms (as in strychnia poisoning) were developed suddenly, and the muscles of the jaw were likewise the last to be affected: when the symptoms began to subside, they did so rapidly. He also adds—the marked difference between the effects of oleander and nux-vomica poisoning consists in the condition of the pulse. In nux-vomica poisoning it is generally

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unaffected, becoming slightly quickened only during a fit; but in oleander poisoning its preternatural slowness is a marked feature.

In Madras oleander pounded with gingelly oil is a favourite poison with suicides. The Madras Chemical Examiner's Report for 1882-83, mentions three cases; for 1888, two cases; for 1885, one case. They were all suicides, the root was detected by its physical characters in the vomited matters.

In the whole of India, during the fifteen years ending 1888, the reports of the Chemical Examiners record 29 detections of oleander,—namely, Bengal, 2; N.-W. Provinces, 2; Madras, 11; Bombay, 14. Two of the detections in Bombay were in connection with cattle poisoning.

THEVETIA NERIIFOLIA, *Juss.*

Fig.—*Bot. Mag.* 2309; *Lyon, Med. Juris. for India*, p. 293. Exile or Yellow Oleander (*Eng.*).

Hab.—West Indies. Cultivated in India. The bark.

Vernacular.—Pila-kanér (*Hind., Guz.*), Kolkaphul (*Beng.*), Pachchai alari, Tiruvachchippu (*Tam.*), Pachcha-gannéru (*Tel.*), Pachcha-arali (*Mal.*), Pivala-kanér (*Mar.*).

History, Uses, &c.—This plant is commonly cultivated in India as an ornamental garden shrub.

Descourtilz, in his *Flora of the Antilles*, speaks of *T. neriifolia* as an acrid poison, of the bark as a drastic purgative, of the fruit as emetic, and of an extract of the plant as a remedy for intermittent fever. He describes the case of a young negro who had eaten of the green fruit, and who was affected with chills, delirium, and other nervous symptoms, nausea, and a thready pulse; he had irregular spasms, followed by extreme agitation, with singing, laughing, and weeping, and then by a fixed blank look. He seemed tending to coma, but was relieved by an emetic.

The antiperiodic properties of the bark have been confirmed by Dr. G. Bidie (*Madras Quart. Med. Journ.* v., p. 178), and Dr. J. Shortt (*Ibid.*, viii., p. 294).

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Their trials with it in various forms of remittent fever proved highly satisfactory, and leave little doubt that it is a remedy of considerable power. It was employed in the form of tincture (one ounce of the freshly-dried bark macerated for eight days in 5 ounces of rectified spirit) in doses of from 10 to 15 drops thrice daily. In larger doses (30 to 60 drops), it acts as an acrid purgative and emetic, and carried to a greater extent is evidently powerfully poisonous. The kernels are extremely bitter, and when chewed produce a slight feeling of numbness and heat in the tongue; by expression they yield a clear, pale amber-coloured, slightly viscid, acrid oil, which is sometimes recommended as a cathartic by the natives, but, according to Dr. Shortt, it produces violent vomiting and hypercatharsis. (*Pharm. of India*, p. 138.) This, however, is contrary to our experience; the oil *when pure* is as inert as olive oil.

Dr. A. J. Amadeo of Porto Rico states that two grains of the extract of the bark, given in the apyrexia of intermittent fever, prevent the access of the paroxysm, and that the natives employ the bark in infusion for the cure of ague. (*Pharm. Journ.*, *April*, 1888.)

The active principles of the plant *Thevetin* and *Theveresin* have been thoroughly tested in experiments on animals by Blas and by T. Husemann (*Archiv für exp. Pathol. u. Phar.*, v. 228). The former has upon frogs the same effects as digitalin, and its lethal dose is also nearly the same (gm. 0·001—0·003). It first hurries the respiration and renders it irregular, and kills by producing a tonic contraction of the ventricle of the heart, with a corresponding engorgement of the auricle and of the general circulation. Voluntary motion is not destroyed, although motility is impaired in the hind legs. The same effects, essentially, were produced by theveresin in the dose of gm. 0·05. Experiments upon dogs and rabbits led these observers to recognize a strong analogy between the effects of these glucosides and the effects of digitalin, helleborin, and other analogous products. They produce repeated attacks of vomiting (in dogs), and sometimes watery diarrhœa

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and profuse salivation, with extreme prostration, so that the animal lies still and will not change his posture except during the efforts at vomiting. The cerebral functions seem to be impaired, at least at the beginning of the attack; later, when exhaustion has become complete, the animal remains motionless, as if narcotized. The breathing is laboured, but the pupils are unchanged, and muscular tremor is constant, although spasms are either absent or only occur just before death. As above stated, in animals killed by these poisons the ventricle is contracted, yet in exceptional cases it is found dilated with dark blood. The vomiting produced by thevetin is doubtless due in part to its irritant qualities, for when it is injected hypodermically the punctures are apt to produce abscesses. The venous congestion of the stomach, which gives the interior of the organ a blue colour, is partly due to the cardiac obstruction and partly to the repeated efforts at vomiting. According to Prof. Carpio (*Phila. Med. Times*, ix. 396), the thevetin of *Thevetia Yccotli* produces symptoms almost identical with those above described, and kills by arresting the heart either in diastole or in systole The experiments of Cerna (*Ibid.*, p. 426,) led him to the following among other conclusions: Thevetin produces death by asphyxia and by cardiac paralysis; applied to the skin, it irritates, with a sensation of burning; it produces convulsions of cerebral and paralysis of spinal origin; increases intestinal paralysis; lowers the temperature; locally applied, it contracts the pupil; and it increases salivation. Warden has confirmed the statement as to the production of convulsions. (*Amer. Jour. Phar.*, liv. 301.)

Description.—The fresh bark of the young wood, of from ½ to 1 inch in diameter, is green, smooth, and covered by a thin grey epidermis, through which thegreen colour is apparent; it turns black when dry. The bark from the larger stems has a brown suberous coating; the wood is white and soft, with a large central pith. All parts of the plant yield an abundance of acrid milky juice. The fruit is globular, slightly fleshy, green, 1½ to 2 inches in diameter, and contains a hard

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nut, light brown in colour, and triangular, with a deep groove along the edge corresponding to the base of the triangle; each nut contains two pale yellow, slightly winged seeds. The seeds and the inner layer of the bark give, when boiled with hydrochloric acid, a deep blue or bluish-green colour.

Chemical composition.—De Vrij has obtained from the kernels of the seeds from 35·5 to 41 per cent. by expression and 57 per cent. with benzol of a limpid almost colourless oil. The oil had an agreeable mild taste like that of fresh almond oil; its density at 25° C. was 0·9148, and at that temperature it was perfectly liquid and transparent, at 15° C. it became pasty, and at 13° C. entirely solid. Oudemans found it to consist of 63 per cent. triolein and 27 per cent. tripalmitin and tristearin. After expression of the oil De Vrij obtained from the cake about 4 per cent. of a beautiful crystallised white glucoside, to which he gave the name of *Thevetin.* A solution of 1·14 gram. of thevetin in glacial acetic acid to a volume of 10 cubic centimetres yielded in the polarimeter a levogyre rotation of 9·75°. With concentrated sulphuric acid thevetin yields a clear, dark yellow liquid, which by exposure to the air assumes after a few minutes a beautiful purple colour. This colour disappears after some time under separation of a flocculent matter. Nitric acid yields no reaction with thevetin at the ordinary temperature. De Vrij has also found thevetin in the bark of the shrub. (For a further account of thevetin and theveresin, see a paper by Dr. Blas in the *Transactions of the Académie des Sciences de Belgique* (3) 2, No. 9—.) Warden has described a principle contained in the seeds which he called *pseudo-indican,* and which affords a blue coloration with hydrochloric acid: he points out that this reaction might be utilized in toxicological investigations. (*Pharm. Journ.,* Nov. 1881.) In another communication to the same journal, he refers to the presence of a second toxic principle in the seeds, which he considers to possess greater toxic powers than thevetin. (*Pharm. Journ. xiii.,* 182-183.)

Toxicology.—Dr. Kanny Lal Dé has drawn attention to the use of the seeds as a poison in Bengal, but erroneously

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ascribes their toxic properties to the bland oil. Dr. Dumontier has published an account of the death of a child three years of age after eating one seed. An interesting case of poisoning by one of the seeds is recorded by Dr. J. Balfour (*Madras Journ. of Lit. and Science, iii., N. Ser.*, p. 140). Recovery ensued. Dr. Lyon (*Med. Juris.*, p. 299) mentions a case in which eight to ten seeds proved fatal to an adult female: he remarks that cases of poisoning in the human subject are seldom met with in India, but of late years the seeds have come into somewhat extensive use in the Bombay Presidency as a cattle poison, nine cases of this kind having been reported in the Bombay Chemical Analyser's Office during the year 1886. In Bengal four other cases are on record, but the particulars of one only are given, in which a woman attempted to commit suicide.

CERBERA ODOLLAM, *Gärtn.*

Fig.—*Wight Ic.*, t. 441; Lyon's *Med. Juris. for India*, p. 300.

Hab.—Swamps and creeks on the coasts of India and Ceylon; Sunderbuns. The seeds.

Vernacular.—Odallam (*Mal.*), Katarali (*Tam.*), Honde (*Can.*), Sukanu (*Mar.*), Dabúr, Dhakur (*Beng.*).

History, Uses, &c.—This is a handsome tree, very plentiful along the backwaters of the western coast. Emetic and purgative properties are assigned to the milky juice, bark and leaves, and the action is very similar to that of *Thevetia neriifolia*. The kernel of the seeds is frequently resorted to in criminal poisoning in the Madras Presidency, and in the native states of Travancore and Cochin. The fruit combined with datura is a part of the remedy given by native physicians for hydrophobia. The bark affords a fibre. The seeds yield 55·5 per cent. of a bland fixed oil, of a pale yellow colour, which is used for burning and for anointing the head; it contains no poisonous property if obtained by expression or by means of petroleum ether.

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Description.—The ripe carpel is ovoid, 2 to 4 inches long, somewhat resembling a green mango, fibrous and woody within, and contains a single broad, compressed, white seed, consisting of two irregularly attached oily cotyledons.

Chemical composition.—Dr. de Vrij has separated from the kernels a crystalline poisonous glucoside, probably the same as thevetin, and an alcoholic extract of the seeds when treated with hydrochloric acid gives a blue or bluish-green colour as exhibited by Thevetia.

Professor Plugge, of Groningen, has made an investigation of the seeds with the following preliminary results. 25 grams of the powder, partially separated from oil by expression, were entirely freed from oil by extraction with benzol, and the remaining powder afterwards extracted with alcohol. From this alcoholic solution it was impossible to obtain any crystalline body, although the solution contained a very poisonous principle. The alcohol was evaporated, and the resulting syrup was dissolved in a few c. c. of water. With this solution subcutaneous injections were made on frogs, and it was found that 0·5, 0·2, 0·1, and even 0·05 c. c. caused death in from five minutes to one hour. The symptoms are chiefly—(1) stoppage of the respiration, or in smaller doses, irregularity of the respiration; (2) violent and repeated vomiting; (3) general paralysis; and (4) finally stopping of the heart in contraction (systole). It seems that the poisonous principle of Cerbera seeds is not only a strong poison of the heart, that, like digitalin, stops the heart in systole, but also has a very marked action on the respiration. The watery solution of *Cerberin* (?) was not precipitated by alkaloid-reagents, with the exception of phosphomolybdic acid. The principle can be best separated from the watery solution of the alcoholic extract, by first shaking it with petroleum ether, and then removing the cerberin with chloroform.

The oil of the kernels has a specific gravity of 9194 at 15·5° C.; at a few degrees below this temperature it deposits solid fats. The saponification equivalent is 259·4, and after decom-

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position of the soap, there is left 95·5 per cent. of insoluble fatty acids melting at 34°. The elaïdin reaction resulted in the solidification of the oil in one hour, and after 24 hours it became so firm as to hardly yield to the pressure of the finger. The ash of the seeds amounts to 3·3 per cent.

Toxicology.—Cases of poisoning with the seeds of Odallam are brought to the notice of the medical officer at Trevandrum every year; they act as an irritant poison by producing vomiting and purging, soon followed by collapse and death. In 1885, out of four cases, one was fatal; in 1886, seven cases were reported. The nut is occasionally eaten by children in mistake, but it is mostly used intentionally by women who wish to commit suicide when they get into trouble. The Madras Chemical Examiner in 1888 reported the case of a boy who, after eating the kernel, "suffered from vomiting and tingling of the skin and throat, deep sleep, and twitching of the muscles, and died in 16 hours." A part of the fruit sent with the viscera was identified.

Pao Pereira.—Under this name the Portuguese in India use the intensely bitter bark of *Geissospermum læve,* which they obtain from Brazil, as a febrifuge and tonic.

Santos (1838) separated from it an alkaloid, *pereirine,* which in its impure state, as a brown-yellow amorphous powder, is employed in Brazil. Bochefontaine and De Freitas (1877) proposed to call it *geissospermine,* and Hesse (1877) adopted this name for the alkaloid, which is nearly insoluble in ether and water and readily soluble in alcohol and dilute acids; it crystallizes in small white prisms, dissolves in strong nitric acid with a purple-red colour, becoming orange-yellow on heating, and in concentrated sulphuric acid at first colourless, rapidly changing to blue, and gradually to a pale colour; its composition is $C^{19}H^{24}N^{2}O^{2}H^{2}O$. A second alkaloid, *pereirine,* is easily soluble in ether, forms a greyish-white amorphous powder, and is coloured blood-red by nitric and violet-red by sulphuric acid; it appears to be present in larger proportion than the preceding one. (*Stillé and Maisch.*)

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TABERNÆMONTANA CORONARIA, *Br.*

Fig.—*Wight Ic. t.* 477; *Bot. Mag.* 1861; *Rheede Hort. Mal. ii.*, 54, 55. Ceylon Jasmine (*Eng.*), Arbre-vache (*Fr.*).

Hab.—Uncertain. Cultivated in India. The milky juice and root.

Vernacular.—Tagar (*Hind., Mar., Guz.*), Nandia-vatai, Nanthia-vatai (*Tam., Tel.*), Nandi-battal (*Can.*), Karáta-pála (*Mal.*).

History, Uses, &c.—This shrub is often confounded with the Tagara of the Nighantas (see *Valeriana Wallichii*). Rheede says that the milky juice of *T. coronaria* mixed with oil is rubbed into the head to cure pain in the eyes; the root chewed relieves toothache; rubbed with water it kills intestinal worms; with limejuice it removes opacities of the cornea. It is the *Fula de S. Antonio* of the Portuguese. Ainslie (ii., 257) states that the Sanskrit name given to it in Southern India is Nandivriksha, and that it is very cooling in ophthalmia. In Western India the milk has the reputation of being very cooling, and is applied to wounds to prevent inflammation. Two wild species, *T. dichotoma* and *T. Heyneana*, are considered to have similar properties, and are known by the same vernacular names. In Pudukota the flowers are used in inflammation of the cornea. The milk of plants belonging to this genus contains caoutchouc and resins, but is generally free from acridity. *T. utilis* is the Hya-Hya or Cow-tree of British Guiana, which yields a copious supply of thick sweet milk when tapped.

Description.—A shrub 6—8 ft., much dichotomously branched, bark pale; leaves 4—6 inches by 1—1½ inch, glossy, rather coriaceous, green when dry, pale beneath, margin waved, petiole ¼—½ in., axils of petioles glandular. Peduncles 1—2 in., pedicels slender, bracts minute. Flowers pure white, often double, fragrant. Follicles 1—3 in., spreading and recurved, sessile or contracted into a sort of stalk at the base, turgidly oblong, beaked or not, 3-ribbed; seeds 3 to 6, oblong,

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striated, aril red, fleshy. (*Fl. Br. Ind.*) All parts of the plant abound in a milky juice, which has a bitter taste.

Chemical composition.—The fresh roots were extracted with 80 per cent. alcohol. From the alcoholic extract, in addition to resins and extractives, a large amount of an alkaloidal principle was isolated, soluble in ether, and giving marked precipitates with alkalies, chromate of potash, and alkaloidal reagents, but no special colour reactions were noted. The taste was bitter, and the principle as deposited by spontaneous evaporation of an ethereal solution, was in the form of a yellowish brittle varnish.

RAUWOLFIA SERPENTINA, *Benth.*

Fig.—*Wight Ic. t.* 849; *Bot. Mag. t.* 784; *Burm. Fl. Zeyl., t.* 64. Syn.—*Ophioxylon serpentinum.*

Hab.—Throughout India. The root.

Vernacular.— Chota-chand (*Hind.*), Chandra (*Beng.*), Harkai (*Mar.*), Pátala-gandhi (*Tel.*), Chuvanna-avilpori (*Mal.*), Covannamilpori (*Tam.*), Sutranabhi (*Can.*).

History, Uses, &c.—This shrub is mentioned in Sanskrit works under the names of Sarpagandhá and Chandrika. The Hindus use the root as a febrifuge, and as an antidote to the bites of poisonous reptiles, also in dysentery and other painful affections of the intestinal canal. By some it is supposed to cause uterine contraction and promote the expulsion of the fœtus. Ainslie gives the following account of it:—*Tsjovanna amelpodi* is the name given, on the Malabar Coast (*Rheede, Mal.* vi. 81, t. 47), to a plant, the bitter root of which is supposed to have sovereign virtues in cases of snake-bites and scorpion-stings; it is ordered in decoction, to the extent of a pint in twenty-four hours, and the powder is applied, externally, to the injured part. The plant is the *Radix mustela* of Rumphius. (*Amb.* vii. 29, t. 16.) The Javanese class it among their anthelmintics, and give it the name of *pulipandak.*

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It may be found noticed both by Burman in his *Thesaur. Zeylan.* (t. 64) and Garcia ab Horto; the latter recommends it as stomachic; Rumphius speaks of it as an antidote to poisons; and Bontius, in his *Hist. Mat. Med. Ind.*, tell us that it cures fever." (*Mat. Ind.* II. 441.) It will be seen that Ainslie confounds it with the *Radix mustela* or ichneumon root (*Ophiorrhiza Mungos*), and the natives of some other parts of India appear to make the same mistake. Sir W. Jones (*Asiat. Research.* iv., p. 308,) thinks it possible that this plant may perhaps be the true ichneumon plant. In the *Pharmacopæia of India* its use in labours to increase uterine contractions is noticed upon the authority of Dr. Pulney Andy, but we have no other evidence of its efficacy in such cases. In Bombay most of the labourers who come from the Concan keep a small supply of the root, which they value as a remedy in painful affections of the bowels. In the Concan the root with *Aristolochia indica* (Sápsan) is given in cholera; in colic 1 part of the root with 2 parts of *Holarrhena* root and 3 parts of *Jatropha Curcas* root is given in milk; in fever the root with *Andrographis paniculata*, ginger and black salt is used. The dose of the combined drugs in each case is from 3 to 4 tolás.

Description.—Root crooked, tapering, from ½ an inch in diameter downwards; bark soft, corky, marked by longitudinal fissures, light brown; wood brittle, showing rings and medullary rays visible to the naked eye; taste very bitter; odour of the fresh root acrid. The suber upon transverse section presents when magnified the appearance of a piece of honeycomb, *viz.*, alternate rows of long tubular cells and compressed cells; the inner portion of the bark consists of a delicate parenchyma, loaded with starch, and traversed by indistinct medullary rays. The wood is remarkably starchy.

Chemical composition.—The roots examined by us reduced to fine powder lost 7·18 per cent. when dried at 100° C. The ash amounted to 7·89 per cent., and was of a light chocolate colour, containing a marked amount of iron and

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a trace of manganese. On analysis the following results were obtained:—

Petroleum ether extract,	·64	per cent.
Ether „	·346	„ „
Alcoholic „	3·936	„ „
Aqueous „	11·38	„ „

The petroleum ether extract was oily, yellow, and possessed an odour like that of a mixture of cedar and musk. On standing arborescent crystals separated; in alcohol the extract was partly soluble with acid reaction; the insoluble residue was oily and contained a trace of a wax. The extract afforded marked indications of the presence of an alkaloidal principle.

The ether extract was hard and had the same odour as the petroleum ether extract, but in a less marked degree. Treated with water a sightly bitter solution was obtained, which gave no reaction with ferric salts: by the action of dilute sulphuric acid an intensely bitter solution was obtained which contained an alkaloid. A yellow resin was also present.

The alcoholic extract was brittle, yellowish brown and intensely bitter. A solution in alcohol exhibited a very marked greenish fluorescence. In cold water the extract was partly soluble, with slight fluorescence, and very bitter: ferric salts gave no colour reaction. The alcoholic extract was treated with dilute sulphuric acid and the turbid acid solution agitated with chloroform: after separation of the chloroform, the liquid was rendered alkaline with ammonia, and agitated first with chloroform ether, and finally with amylic alcohol. The three extracts exhibited fluorescence when dissolved in alcohol, but the appearance was most marked in that obtained by chloroform acting on the acid solution. The chloroform extract deposited a yellowish granular mass on standing, which was non-crystalline: in taste the extract was extremely bitter: it afforded marked indications of the presence of an alkaloid, but was not wholly soluble in diluted sulphuric acid. The ether-chloroform extract was non-crystalline, it was also

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bitter, but the bitter taste was associated with some astringency; it was wholly soluble in dilute sulphuric acid, and afforded marked indications of the presence of an alkaloid.

The amylic alcohol extract was of a dark colour, and wholly soluble in dilute sulphuric acid, and very bitter: it also gave marked alkaloidal reactions. With sulphuric acid, none of the extracts afforded crystalline salts.

The aqueous extract had a bitter taste; it reduced an alkaline copper solution on boiling: with ferrocyanide of potassium and acetic acid a faint turbidity was produced. The residue insoluble in water contained a large amount of starch.

At present we do not offer any opinion as to whether the alkaloidal principles we have referred to in the various extracts are identical or not: we are also at present unable to state whether these alkaloids are new or merely principles which have already been described as occurring in other plants of the same natural order. An analysis of the root of *Ophioxylon serpentinum* by W. Bettink has been published in Haaxman's *Tijdschrift* (Jan. 1888), where no alkaloid is reported to have been found, but a crystalline body related to juglone. We feel convinced that the drug examined by Bettink was not authenticated. Prof. Eykman has recorded the discovery of an alkaloid in an Indian species of *Ophioxylon*, and later still (1890), M. Greshoff has found an alkaloid giving a veratrine reaction with Frohde's reagent, thus substantiating our analysis. It is probable that as the root resembles Plumbago root, Prof. Bettink's ophioxylin was only plumbagin.

ALLAMANDA CATHARTICA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 338. *Syn.*—*A. Aubletii*, Rohl.

Hab.—America. Cultivated in India and has run wild in the tidal backwaters of the Western Coast and at Goa.

Vernacular.—Jahari-Sontakka (*Mar.*), Arasina (*Can.*).

History, Uses, &c.—This beautiful climbing shrub is very common in gardens, and is said to have been introduced

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into India from Brazil by the Portuguese. The flowers are offered by the Hindus in their temples, and they appear to be aware of the poisonous nature of the plant, as the Marathi name signifies "poisonous Sontakka." Sontakka is the name for *Hedychium flavum*, the flowers of which have some resemblance to those of Allamanda. We have not heard of the plant being used medicinally in this country, but Ainslie (*Mat. Ind.* ii. 9,) has a short notice of it, and mentions its use at Surinam by the Dutch as a cathartic. Poupée Desportes of St. Domingo recommends the extract of the bark, in doses of 1 to 2 grains, as an excellent hydrogogue cathartic. The leaves are also said to have been used in the cure of painters' colic. In large doses all parts of the plant are violently emetic and cathartic.

Description.—*A. cathartica* has elliptic lanceolate leaves arranged in fours round the stem on very short petioles. The flowers are large, yellow, and funnel-shaped, and are borne at the ends of the branches. The fruit is globular, the size of a small walnut, and thickly set with long soft spines; it contains several flat seeds with a membranous margin. All parts of the plant abound in a thick milky juice.

Chemical composition.—The fresh leaves were pulped and digested with 80 per cent. alcohol. The green tincture was concentrated and when free from alcohol, the extract was agitated with benzole, which removed colouring matters, &c. The aqueous solution was then acidulated with sulphuric acid and agitated with ether. The extract was indistinctly crystalline, and partly soluble in water, affording a dark brownish-green coloration with ferric chloride, and precipitating an alkaline copper solution on boiling. The portion insoluble in water was dissolved by alkalies with bright yellow coloration, and reprecipitated in yellowish-brown flocks by acids. The original aqueous solution was now rendered alkaline and agitated with ether; the extract did not exceed a trace, was indistinctly crystalline, and afforded marked indications of the presence of an alkaloid. The dark brown alkaline solution was now acidulated with sulphuric acid and agitated with amylic alcohol.

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The amylic alcohol extract consisted of a dark brown strongly acid glucosidal acid, soluble in water, and forming soluble compounds with alkalies, astringent matter giving a dirty greenish coloration with ferric chloride, and dark brown flocks insoluble in water, probably phlobaphene.

We injected ·495 of a gram of the amylic alcohol extract dissolved in water and a few drops of ammonia, into a fasting cat's stomach without inducing purgative effects. In another experiment we employed the dried leaves, which were extracted with alcohol, then dried, moistened with dilute sulphuric acid, and extracted with hot alcohol in the manner described by Stockman in his note on the active principle of Senna leaves (*Pharm. Journ.* [3] XV., 749). Operating in this manner we isolated a glucosidal acid which had some purgative action when injected into a cat's stomach, and which a more thorough investigation may prove to be similar to cathartic acid. The point is of some economic importance, as the plant is a very common one, and has the reputation of being a valuable cathartic.

CARISSA CARANDAS, *Linn.*

Fig.—*Wight Ic.*, *t.* 426 and 1289; *Roxb. Cor. Pl. I.*, *t.* 77; *Bedd. Fl. Sylv.*, *t.* 19, *f.* 6.

Hab.—Throughout India, in dry, sandy or rocky ground.

The bark, leaves and fruit.

Vernacular.—Karaunda, Karonda, Timukhia (*Hind.*), Kurumia, Karamcha (*Beng.*), Karavanda (*Mar.*), Kalaka (*Tam.*), Kalivi-kaya (*Tel.*), Karekai, Korinda (*Can.*), Karamada (*Guz.*).

History, Uses, &c.—This shrub is the Karamardaka and Krishna-phala of Sanskrit writers, and is described in the Nighantas as heavy, hot, and acid when unripe, and a generator of the three humors: when ripe it is said to be sweet, light, and digestive, and an expellant of bilious and rheumatic humors. The fruit is generally made use of by both Europeans and natives

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on account of its acid and antiscorbutic properties; when unripe it makes a good pickle and when ripe an excellent tart fruit. A jelly, similar to red currant jelly, is also made from it by Europeans. In Orissa a decoction of the leaves is much used at the commencement of febrile complaints. The root is acrid and bitterish, and is applied in the form of a paste with lime-juice and camphor as a remedy for itch and to keep off flies.

Description.—A large shrub, with many dichotomous, rigid, spreading branches; axils and nodes with two simple or forked thorns, sometimes 1 to 2 inches long. Leaves subsessile, 1½ to 3 by 1 to 1¾ in., rather thinly coriaceous, base rounded or retuse, tip rarely mucronate. Drupes ½ to 1 in. long, ellipsoid, turning from green to red, then black, polished, four or more seeded. The root-bark is remarkable for its numerous large stone cells, often more than an inch in length, which form a network round the wood.

Chemical composition.—The roots were air-dried, reduced to powder, and digested with 80 per cent. alcohol. The alcohol-free extract was mixed with water, dilute sulphuric acid added, and agitated with benzole, which separated an oil of the consistence of honey at 75° F., and partly soluble in absolute alcohol with acid reaction. A trace of volatile oil was also present, with an odour similar to that of Piper Betle leaf oil. During agitation with benzole a mass of dark-yellowish resin separated, which caked. The liquid containing the separated resin was next agitated with ether. The ether extract was not more than a trace, and contained salicylic acid. The insoluble mass of resin was now separated, and the aqueous solution rendered alkaline and agitated with ether. The ether extract contained an alkaloid which gave marked precipitates with the usual reagents. The dark brown yellowish resin, insoluble in ether and benzole, was wholly soluble in ammonia, and on spontaneous evaporation left a brittle residue. The ammoniacal solution when freshly made was yellow, but on standing became green, and on spontaneous evaporation the solid residue was brownish.

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PLUMERIA ACUTIFOLIA, *Poir.*

Fig.—*Wight Ic. t.* 471; *Bot. Mag. t.* 3952; *Bot. Reg. t.* 114. Jasmine tree (*Eng.*), Frangipanier (*Fr.*).

Hab.—Uncertain. Cultivated throughout India. The bark and flowers.

Vernacular.—Khair-champa, Sufed-champa (*Hind.*), Gobarchampa (*Beng.*), Dolo-champa (*Guz.*), Khera-chapha (*Mar.*).

History, Uses, &c.— This plant is the *Flos convolutus* of Rumphius (vi. 43), who states that it is not used medicinally in Amboyna, but remarks that its juice partakes of the nature and properties of Gamboge. It appears to have been introduced into India by the Portuguese from Brazil, as it is usually planted in the churchyards of the native Christians, in order that it may deck the graves with its white deciduous flowers, which are produced almost all the year round. The Hindus make use of its flowers in religious ceremonies, and have given the Sanskrit name of Kshira-champa, "milky Champa," to the shrub. Mir Muhammad Husain describes the tree under the name of A'chin (آچین), and states that the root-bark is a strong purgative, and also a useful remedy in gonorrhœa and for venereal sores. He recommends buttermilk to be given in cases of excessive purgation after its use. Plasters made of the bark are said to be useful in dispersing hard tumours.

The natives of India frequently use the bark as a purgative and apply the heated leaves to dispel swellings, and the milky juice as a rubefacient in rheumatic pains, and with sandalwood oil and camphor to cure itch.

The flower buds are eaten with Betel leaves as a febrifuge. Dr Hové, who visited Bombay in 1787, found the plant growing abundantly on Malabar Hill, which was then uninhabited, He remarks that the natives use it in intermittents as we do Cinchona.

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Dr. A. J. Amadeo (*Pharm. Journ.*, April 21st, 1888,) has the following account of its medicinal uses in Porto Rico:—"In small doses (8 to 12 grains) given in emulsion the milk produces abundant bilious watery stools. The bark is a favourite remedy with the country people for gonorrhœa and gleet. Two ounces of the fresh powdered bark is placed in 8 pints of *eau sucrée* and exposed to the sun for four days, being shaken occasionally. A wineglassful is administered four or five times a day, together with refreshing and mucilaginous drinks, and the use of tepid baths. The action of the drug is at first purgative, afterwards diuretic. An extract of the bark may be used beginning with 3—4 grains daily to be gradually increased to 14 or 15 grains, or a wine (1 oz. to 1 litre) may be given in liqueur glassfuls three times a day. The decoction of the bark is a powerful antiherpetic.

Chemical composition.—The milky juice collected by de Vrij and evaporated to dryness at 100°, was found to yield 30·5 per cent. of residue, consisting chiefly of an organic calcium salt, a kind of caoutchouc, and resins. To isolate the calcium salt A. C. Oudemans exhausted the substance with petroleum-naphtha, and treated the residue with dilute acetic acid, which dissolved the salt, while parts of the plant and a humus-like mass remained behind. On concentrating the solution, calcium salts of different forms separate out, all, however, containing the same acid, *Plumieric*, $C^{10}H^{10}O^{5}$.

The free acid is obtained by converting the calcium salt into potassium plumierate, decomposing the latter with sulphuric acid, and extracting the solution with ether. It is readily soluble in alcohol and freely but slowly in ether. In cold water it dissolves but very sparingly, and from a hot solution it separates in microscopic crystals, or on slow evaporation in indistinct crusts. It melts at 139°, and decomposes at a temperature a few degrees higher, giving off first water and acetic acid, then an oily distillate having the odour of cinnamic aldehyde, while a small quantity of a crystalline substance sublimes. When the oil is oxidised, a crystalline acid is

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formed. On melting plumieric acid with potash, an acid is formed, giving the characteristic reactions of salicylic acid.

Plumieric acid is most probably a methoxyl-hydroxycinnamic acid ($C^6H^2(OH)^2(CH^2OH)(COOH)$), and forms four series of salts, according as only the carboxylic hydrogen, or in addition one or more of the three hydroxylic hydrogens, is replaced by a metal, when plumieric acid is oxidised by a dilute solution of chromic acid, it is redissolved into formic acid (or carbon dioxide) and the acid $C^9H^8O^4$, which is very sparingly soluble in water; its silver salt, $C^9H^5Ag^3O^4$, separates from a warm solution in fibrous crystals.

When plumieric acid is heated with water and sodium amalgam on a water bath, it combines slowly with hydrogen to form hydroplumieric acid, $C^{10}H^{12}O^6$, which on evaporation of its ethereal solution, separates as a varnish, becoming crystalline on standing, and freely soluble in water. (*Watts' Dict. of Chem.* viii., p.1656.)

Toxicology.—The use of this bark as a purgative is not without danger, as several cases of death from excessive purging after its use have been recorded. In a case reported in 1886, by Surgeon K. R. Kirtikar (*Trans. Bombay Med. and Phys. Soc.*) the quantity taken was about a square inch; this was pounded, mixed with water, and swallowed by a man aged 25 as a remedy for colic. The symptoms were vomiting, depressed heart's action, and somewhat dilated pupils. S. Arjun (*Bombay Drugs*, p. 210,) states that the blunt ended branches are used to procure abortion. We are not in a position to state whether plumieric acid is the active principle or not.

Ichnocarpus frutescens, *Br. Wight Ic. t.* 430; *Burm. Zeyl.*, *t.* 12, *f.*1, is an extensive climber. Leaves very variable, 2 to 3 by ¾ to 1½ inch, petiole ¼ inch, cymes 1 to 3 inches, axillary and in terminal panicles, rusty-pubescent, branches short, trichotomously divided or 3-flowered, pedicels longer or shorter than the corolla, calyx-lobes ovate, obtuse or subacute, eglandular. Corolla about ¼ inch in diameter,

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purplish, twice as long as the calyx, lobes twice as long as the tube, falcate, acuminate, mouth and margins sparingly bearded. Disc-glands, 5, erect, slender, capitate, much longer than the hairy ovary. Style very short. Follicles 3 to 6 by $\frac{1}{8}$ inch, very slender, cylindric, curved, acute. Seeds $\frac{1}{2}$ inch, very slender, not beaked; coma scanty, white. (*Fl. Br. Ind.*) The plant is described by Roxburgh (*As. Res.* 1,261) under its native name of *Syama* or *Syamalata*; it is a native of the Western Himalaya, Upper Gangetic Plain, Bengal, the Deccan Peninsula and the Southern Concan. In the Northern Concan and Guzerat it appears to be unknown. In Hindustan and Bengal it is known as Syamalata, "black-creeper," and in the Deccan Peninsula as Krishna-sáriva; the Canarese name is Kari-umbu, "black-creeper."

The roots are somewhat similar in appearance to those of Hemidesmus, but have not the same coumarin odour. The bark is of a dark brown colour, and adheres closely to the wood, which is much harder, and differs in structure from that of Hemidesmus in having a large central pith. The roots are seldom branched, but here and there a few fine fibres are given off; they are almost tasteless. For the properties and uses of this plant, the reader is referred to Hemidesmus.

Chemical composition.—The root contains a caoutchouc-like substance soluble in benzol, and a soft, brown, tenacious resin soluble in ether. Treated with alcohol the powdered root affords about 10 per cent. of dry extract, containing red colouring matter, tannic acid, and a small quantity of coumarin. The tannic acid strikes a green colour with ferric chloride, and if to this green mixture a drop of soda solution is added, a bright blue zone is seen to surround the red coloured spot formed by the alkali. This reaction is peculiar to cinchotannic acid. No alkaloidal body could be detected in this drug.

Vinca pusilla is the Kupa-veela of Rheede (*Hort. Mal.* *ix.* 33), who states that the plant boiled in oil is rubbed on the loins in lumbago.

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ASCLEPIADEÆ.

CRYPTOSTEGIA GRANDIFLORA, *Br.*

Fig.—*Bot. Reg., t.* 435; *Wight Ic., t.* 832, and *Ill.* ii., *t.* 182, *f.* 9; *Reichb. Ic. Exot., t.* 192.

Hab.—Africa or Madagascar. It is cultivated and has run wild in various parts of India.

Vernacular.—Viláyati-vákhandi (*Mar.*), Palai (*Mal.*).

History, Uses, &c.—This ornamental climbing shrub has been named *Vilayati-vákhandi*, "foreign Vakhandi," by the Marathas from the resemblance of its foliage to that of *Gymnema sylvestre* (Vákhandi).

It has attracted attention on account of a caoutchouc prepared from its milky juice at the botanic garden, Hyderabad, Sind, in 1882. (See *Watts' Dict. Econ. Prod. of India* ii., p. 625). We notice the plant as a case of poisoning by its leaves has been reported in the Bombay Chemical Analyser's Report for 1877-78. In this case the pounded leaves mixed with water are said to have been swallowed. Persistent vomiting came on half-an-hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present.

Description.—An extensive climbing shrub, leaves 3—4 by 1½ to 2 in., coriaceous, glossy above, nerves many, spreading, arched, faint, base acute; petiole ½ to ⅝ in.; cymes short, spreading, peduncles and branches stout, hoary or glabrous; bracts caducous; corolla pale pinkish purple, tube and throat 1½ in. long, limb often 2 in. diam., lobes acute; follicles 4—5 by 1—1½ in., broadest near the base, straight, woody; seeds ¼ in. long, oblong-ovate, compressed, narrowed upwards; coma 1½ in., very fine. (*Fl. Br. Ind.* iv., p. 6.)

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Chemical composition.—The leaves contain a caoutchouc-like body (described by Warren—See *Watt's Dict. Econ. Prod.* Vol. ii., p. 625,) and afford 14·5 per cent. of ash. The aqueous solution of an alcoholic extract is coloured green with ferric chloride, precipitated yellow with plumbic acetate and strong alkalies, and is unaffected by tannin, alkaloidal reagents and gelatine. Evaporated portions were crystalline, and dissolved with evolution of gas in strong sulphuric acid with an orange colour, turning brown when heated. The solution when saturated with ether and allowed to stand with an excess of the ether, threw out a number of crystals on the sides of the vessel. These crystals appeared white in the presence of the mother liquor, but when removed by filtration and washed, they had a slight yellow tinge. They were soluble in alcohol, but sparingly so in ether and water, and insoluble in benzol and chloroform. Alkalies and lime and baryta water dissolved them with a yellow colour, and a soluble compound was formed with magnesia. No colour was given with ferric salts unless the substance was previously neutralized, and then a green solution was produced. The crystals dissolved with a yellow colour in sulphuric acid discharged on dilution with water, and in nitric acid with a transient red brown colour. The crystals were acid in reaction and blackened steel when left in contact with it; they melted at 168° C. The mother liquor turned green and precipitated with ammonia, and showed evidence of a large amount of glucose by readily reducing Fehling's solution.

The leaves were powdered and given to animals to test their alleged poisonous properties. 5 to 10 grain doses were given to several chickens, 2 grams was given to a dog, and 5 grams, representing 20 leaves, was given to a fowl, with no results whatever in either case. The inspissated aqueous extract from 20 grams of the leaves was administered to a guinea pig without affecting its health. We must therefore conclude that the leaves are not poisonous, and could not have been the cause of the persistent vomiting in the case reported by the Bombay Chemical Analyser.

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ASCLEPIAS CURASSAVICA, *Linn.*

Fig.—*Bot. Reg.*, *t.* 81. Bastard Ipecacuanha (*Eng.*), Asclepiade de Curaçao (*Fr.*).

Hab.—West Indies. Introduced into India.

Vernacular.—Kurki (*Mar.*), Kakatundi (*Hind.*).

History, Uses, &c.—This perennial herb is indigenous to South America and the West Indies, where, in common with several other species of Asclepias, it is known as Milkweed, Silkweed or Wild Cotton. All of these plants have properties similar to Calotropis. The root of *A. curassavica* is employed in the West Indies as an emetic, and the milky juice which, when dry, forms a tough adhesive pellicle, is used to close wounds and excoriations of the skin. In Martinique the plant is called *Ipecacuanha blanc*, and in Guadaloupe *Herbe à Madame Boivin*, and the root is used in the same doses as Ipecacuanha. Introduced into India as a garden plant it has now run wild in many places, but, as far as we know, is not used medicinally by the natives.

Dr. Guimaraës (*Times and Gazette*, 1881, p. 661,) found it to act directly upon the organic muscular system, and especially upon the heart and blood vessels, causing great constriction of the latter and distension of the larger arteries. Secondarily it occasioned great dyspnœa, vomiting and diarrhœa.

Description.—Root-stock short, abruptly divided into numerous thin, pale yellowish-brown, and internally whitish rootlets. The bark is thin, and when fresh exudes a milky juice; taste bitter and somewhat acrid. A section of the root bark placed under the microscope shows from without inwards—*1st*, a suberous layer; *2nd*, several rows of large cells containing conglomerate raphides, with starch and granular matter; *3rd*, a vascular zone, two or three large dotted vessels being situated at the cambium end of each medullary ray, where it projects into the bark.

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The plant may be easily recognised by its oleander-like leaves, and red and orange flowers in terminal bunches. The follicles are like radish pods.

Chemical composition.—Dr. Gram (*Archiv. f. exp. Path. u. Pharm.* xix., 384,) has found the plant to contain an active principle of a glucosidal character, which he has named *asclepiadin*, and appears to consider a purer form of the asclepiadin of Harnack and the *asclepin* of Feneulle. This substance was yellowish, amorphous, and when freshly prepared very soluble in water; but either in solution or in a dry state it quickly decomposed, sugar being separated, and the residual compound becoming in proportion insoluble in water and inert. From an ethereal solution crystals gradually separated out, apparently identical with List's *asclepione*, and quite inactive physiologically.

The physiological action of the unaltered asclepiadin was found to closely resemble that of emetin, but in view of the instability of the compound, Dr. Gram doubts whether it can be advantageously introduced into medicine.

Asclepione, $C^{40}H^{34}O^{6}$, was discovered by C. List in the milk sap of *Asclepias syriaca.* (*Gmelin Handb.* 17, 368.) Feneulle separated a resinous substance and a bitter principle (asclepin) from *Asclepias Vincetoxicum.* (*J. Pharm.* 11, 305.)

CALOTROPIS GIGANTEA, *R. Br.*

Fig.—*Wight Ill., t.* 155; *Griff. Ic. Pl. As., t.* 397, 398. Gigantic Swallowwort (*Eng.*), Arbre a soie (*Fr.*).

Hab.—Throughout India, Malay Islands, S. China.

CALOTROPIS PROCERA, *R. Br.*

Fig.—*Wight Ic., t.* 1278; *Bentl. and Trim., t.* 176

Hab.—W. and Central India, Ava, Persia to Africa. The root bark, milky juice and flowers.

Vernacular.—Ak, Madár (*Hind.*), Akanda (*Beng.*), Akra, Rui (*Mar.*), Erukku, Yercum (*Tam.*), Jilledu-chettu, Mandáramu (*Tel.*), Akado (*Guz.*), Ekke-,Yakke-gida (*Can.*)

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History, Uses, &c.—Calotropis is mentioned by the earliest Hindu writers, the leaves, *arkapattra, arkaparna,* "sun leaf" or "lightning leaf," so called from their cuneiform shape, were used in Vedic times in Sun-worship. According to the Shatapatha Bráhmana every part of the human form was supposed to be represented in the different parts of the plant, nevertheless it would appear to have been dreaded (*Panchatantra* i. 57), and was supposed to blind those who approached it. (*Mahabhárata* i. 716.) These myths appear to have arisen from the Hindus attributing to the plant the properties possessed by lightning and the sun's rays. (*De Gubernatis.*) As a medicine Calotropis is noticed by Susruta and other medical writers, some of whom mention two varieties, *arka,* and *alarka,* "a white-flowered kind." Calotropis bears many synonyms in Sanskrit, such as Rudra, Aditya, Suryapattra and Mandára, from the last of which is derived the vernacular form Madár.

In Western India, and probably elsewhere, there is a curious superstition that a leaf of the Akra (Arka) fetched from the tree with certain ceremonies is of use in tedious labour. The friends of the woman take a packet of betelnut and leaf and a piece of money, and proceed to the plant, which they address in the most respectful manner, placing the betel packet at its root and asking for the loan of one of its leaves, which they promise to return shortly. They then take away a leaf and place it upon the head of the parturient woman, where it remains for a short time, and is afterwards returned to the plant. This practice appears to be connected with the worship of the Maruts or winds, demigods subject to Rudra, to whom these plants are sacred. The Maruts are worshipped on Saturday with a garland of the flowers. The twigs are used as *samidhas,* and the leaves are used by some in the *shati puja* to propitiate the goddess of parturition. Calotropis is also the *kul* or *Arbor generationis* of the Bhandári caste, whose business it is to tend the palm gardens and extract the juice of the trees. Another custom general amongst all castes of Hindus is that a man who has lost three wives must make his fourth marriage with

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the Arka tree, after which he may take a fourth human wife. The object of this seems to be to transfer the man's ill-luck to the plant. The ancient Arab tribes appear to have held superstitious notions about Calotropis, probably connected with Sun-worship. *C. procera* was first described by Abu Hanifeh *circa* 270 A.H. in his Book of Plants. From the Kámus and the Táj-el-arūs we learn that Ushar was used by the Arabs in the Time of Ignorance along with سلع (salaa) in the practice called تسليع (tasliaa) which was observed in time of drought or barrenness of the earth. It consisted in tying the dried plants to the tails of wild bulls, setting fire to them, and driving the animals down from the mountains, seeking to obtain rain by the flame of fire, which was likened to the gleaming of lightning. The *Salaa* from Abu Hanifeh's description appears to have been a kind of Cuscuta. According to the Burhan, عشر (ushr) is a Persian name for all plants having a milky juice, and especially for the plant known in Hindustan as Ák. It would therefore seem that Ushar is not an Arabic word, as generally stated in the Dictionaries, but of Arian origin, and perhaps connected with the Sanskrit verb उष to burn. The wood is considered to make the best charcoal for the preparation of gunpowder, and Ushar silk خزع is used to stuff cushions by the Arabs, and also to make tinder (makhad), called by the Tartars yálish. Ibn Sina notices Ushar, and an exudation obtained from it called Sakar-el-ushar; he also mentions a superstitious notion that it is fatal to sit under the tree. The author of the Minháj describes Sakar-el-ushar as a gum which exudes from the inflorescence of the plant and gradually hardens. (He remarks that people say that it is a dew which falls upon the plant and concretes like manna.) Some medical writers confound it with Sakar-el-tighál. Abu Hanifeh and the author of the Obáb describe it as an exudation from the flowering parts of the plant. The best authorities describe its properties as similar to those of the juice of the plant, it would therefore seem to be nothing more than an exudation of the juices of the plant which naturally contain some sugar. Calotropis is not mentioned by Greek or Roman writers, but some Mahometans give *Hejukiyus* as its

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Yunani name; this appears to be a corruption of the word ἡγιάθεος, "most holy," or "under divine protection," and was probably applied to the plant by some of the Syrian physicians who instructed the Arabs in Greek medicine. The modern Persians call *C. procera* Khark and Darakht-i-zahrnàk, or "poison tree."

By Hindu physicians the root bark is said to promote the secretions and to be useful in skin diseases, enlargements of the abdominal viscera, intestinal worms, cough, ascites, anasarca, &c. The milky juice is regarded as a drastic purgative, and caustic, and is generally used as such in combination with the milky juice of *Euphorbia neriifolia*. The flowers are considered digestive, stomachic, tonic and useful in cough, asthma, catarrh and loss of appetite. The leaves mixed with rock salt are roasted within closed vessels, so that the fumes may not escape. The ashes thus produced are given with whey in ascites and enlargements of the abdominal viscera. The following inhalation is prescribed for cough: Soak the powdered root bark of Arka in its own milky juice and dry. Bougies are then prepared from the powder, and their fumes inhaled. The root bark, reduced to a paste with sour conjee (rice vinegar), is applied to elephantiasis of the legs and scrotum. The milky juices of *C. gigantea* and *Euphorbia neriifolia* are made into tents with the powdered wood of *Berberis asiatica*, for introduction into sinuses and *fistulæ in ano*. The milky juice is applied to carious teeth for relief of pain." An oily preparation (*Arka taila*) made by boiling together 8 parts Sesamum oil, 16 parts Calotropis juice, and one part turmeric, is said to be useful in eczema and other eruptive skin diseases. In the Concan the milk with powdered mustard is applied as a *lep* to rheumatic swellings, the flowering tops pounded and boiled with molasses, are given in doses of about one drachm every morning as a remedy for asthma. In want of virility the following prescription is in vogue: Take 125 of the flowers, dry and powder, then mix with one tolá each of cloves, nutmegs, mace and pellitory root, and make into pills of six massas each. One pill may be taken daily dissolved in milk.

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The author of the *Makhzan-el-adwiya* says there are three varieties of Calotropis—1*st*, a large kind with white flowers, large leaves, and much milky juice, it is found near towns and the habitations of man; 2*nd*, a smaller kind with smaller leaves, the flowers white externally but lilac within; 3*rd*, a still smaller plant, with pale yellowish green flowers. The second and third kinds grow in sandy deserts. The properties of all three are similar, but the first kind is to be preferred, as it produces the largest quantity of milk. The juice is described as caustic, a purge for phlegm, depilatory, and the most acrid of all milky juices. Tanners use it to remove the hair from skins. Medicinally, it is useful in ringworm of the scalp, and to destroy piles; mixed with honey it may be applied to aphthæ of the mouth; a piece of cotton dipped in it may be inserted into a hollow tooth to relieve the pain. Hakím Mír Abdul Hamíd, in his commentary upon the Tuhfat, strongly recommends Calotropis in leprosy, hepatic and splenic enlargements, dropsy and worms. A peculiar method of administration is to steep different kinds of grain in the milk and then administer them. The milk itself is a favourite application to painful joints, swellings, &c., the fresh leaves also, slightly roasted, are used for the same purpose. Oil in which the leaves have been boiled is applied to paralysed parts; a powder of the dried leaves is dusted upon wounds to destroy excessive granulation and promote healthy action.

All parts of the plant are considered to have valuable alterative properties when taken in small doses.

C. procera was observed in Egypt by Prosper Alpinus (A. D. 1580—84), and upon his return to Italy was badly figured, and some account given of its medicinal properties. (*De plantis Ægypti*, Venet. 1592, cap. 25.) A much more correct figure was published in 1638 by his commentator Vesling. Rheede (*Hort. Mal.* ii., t. 31) figures a white-flowered Calotropis (*Bel-ericu*) and a lilac (*Ericu*), and Rumphius (*Hort. Amb.* vii., t. 14, f. 1) figures *C. gigantea* under the name of *Madorous*. Roxburgh (II., 30,) gives a botanical description of *C. gigantea* under the name of *Asclepias gigantea*, and

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mentions the medicinal uses to which it is applied by the natives of India. Ainslie, in his *Materia Medica of Hindustan* (1813), mentions two kinds of Calotropis, and in the *Materia Indica* he says, "Both plants in their leaves and stalks contain much milky juice, which, when carefully dried, is considered as powerfully alterative and purgative, and has been long used as an efficacious remedy in the Koostum (lepra Arabum) of the Tamools; the dose about the quarter of a pagoda weight in the day, and continued for some weeks. The root of the *Yercum* has a bitter and somewhat acrid, or rather warm taste; it is occasionally given in infusion as a stimulant in low fever. Of the other variety, the *Vullerkoo*, the bark is warmish, and when powdered and mixed with a certain portion of margosa oil, is used as an external application in rheumatic affections. In the higher provinces of Bengal the Arka is supposed to have antispasmodic qualities. Mr. Robinson has written a paper on elephantiasis, which may be seen in Vol. X. of the *Journ. of the Medico-Chirurgical Society*, extolling the madar root (Yercum vayr) as most efficacious in that disease, as also in venereal affections. In elephantiasis he gave it in conjunction with calomel and antimonial powder, in a pill, consisting of half a grain of calomel, three of antimonial powder, and from six to ten of the bark of the madar root, every eight hours. Mr. Playfair has also written a paper on the same root which may be seen in Vol. I. of the *Edin. Med. Chirurg. Trans.*, p. 414, wherein he speaks in praise of the alterative, stimulant, and deobstruent virtues of the bark, or rather rind below the outer crust of the root, reduced to fine powder, in cases of syphilis, lepra, hectic fever, &c., dose from grs. 3 to 10 or 12, three times in the day, gradually increasing it. Messrs. Robertson, Playfair, and others seem chiefly to dwell on the virtues of the rind or bark of the root; but I must observe, that in Lower India, where I was for many years, I found the simple dried milky juice considered as infinitely more efficacious; and later communications from the East confirm me in this opinion." (*Op. cit.* I., p. 487.)

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The emetic properties of Calotropis were brought to the notice of the profession in Europe by Dr. Duncan in 1829 (*Edin. Med. and Surg. Journ.*, XXXII., p. 65), and they are noticed in the *Bengal Dispensatory*, where the drug is recommended as a substitute for Ipecacuanha. Since the publication of that work abundant testimony in its favour has been collected, a summary of which will be found in the *Pharmacopœia of India.* Duncan (1829) made a chemical examination of the root bark, the activity of which he referred to an extractive matter which he termed *Mudarine.* A kind of gutta-percha was obtained from the juice of this plant by Dr. Riddell, Superintendent Surgeon H. H. the Nizam's Army, in 1851. (*Journ. Agri-Hort. Soc. of India*, Vol. VIII.) In 1853 it was examined by Prof. Redwood, who found it to possess many properties in common with the gutta-percha of commerce. No further trial of this substance appears to have been made during the last 37 years.

Modern physiological research has shown that the juice applied to the skin acts as an irritant, the practice of applying it with salt to bruises and sprains to remove pain is therefore rational; also the application of the fresh bark in chronic rheumatism. Given internally in small doses the drug stimulates the capillaries and acts powerfully upon the skin, it is therefore likely to be useful in elephantiasis and leprosy. (*Casanora.*) The benefit derived from the administration of the flowers in asthma is probably due to their nauseant action. In large doses Calotropis causes vomiting and purging, acting as an irritant emeto-cathartic.

Description.—The root barks of *C. gigantea* and *C. procera* are similar in appearance, and occur in short quilled pieces ⅛ to ½ of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured longitudinally, and can be easily separated from the middle cortical layer, which is white, friable, and traversed by narrow brown liber rays. The taste is mucilaginous, bitter and acrid, and the odour peculiar.

Microscopic structure.—In both kinds of root bark the suber consists of large thin-walled cells, generally polyhedral. The

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parenchyme of the middle cortical layer is loaded with starch and contains some sclerenchymatous cells. The cells of the medullary rays also contain starch and crystals of oxalate of lime. In the middle layer are numerous laticiferous vessels, the contents of which are of a brown colour.

Chemical composition.—The authors of the *Pharmacographia* state, that by following the process of Duncan, 200 grammes of the powdered bark of *C. gigantea* yielded nothing like his mudarine, but 2·4 grammes of an acrid resin soluble in ether and alcohol. The latter solution reddens litmus; the former on evaporation yields the resin as an almost colourless mass. When the aqueous liquid is separated from the crude resin, and much absolute alcohol added, an abundant precipitate of mucilage is obtained, and the liquid now contains a bitter principle, which after due concentration may be separated by means of tannic acid. Similar results were obtained by exhausting the bark of *C. procera* with dilute alcohol. The tannic compound of the bitter principle was mixed with carbonate of lead, dried, and boiled with spirit of wine. This after evaporation furnished an amorphous, very bitter mass, not soluble in water, but readily so in absolute alcohol. The solution is not precipitated by an alcoholic solution of acetate of lead. By purifying the bitter principle with chloroform or ether, it is at last obtained colourless. This bitter matter is probably the active principle of Calotropis; they ascertained by means of the usual tests that no alkaloid occurs in the drug. (*Op. cit.*, 2nd Ed., p. 426.) Drs. Warden and Waddell (1881) commenced an examination of Madár root bark in Calcutta, and obtained a substance crystallizing in nodular masses, which they thought would prove to be the *Asclepione* of List, but subsequently (1885), upon Warden continuing the investigation of the drug in the Chemical Laboratory of the Gesundheits Amt, Berlin, he found the substance supposed to be asclepione to have a composition corresponding with the formula $C^{17}H^{28}O$, whereas List's asclepione is represented by the formula $C^{20}H^{34}O^{3}$.

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The white cauliflower masses of crystals obtained in Berlin were found to agree closely, as regards their melting point and behaviour with solvents, with a substance called *Alban*, obtained by Payen from gutta-percha (*Jahresbericht über die Fortsch. der Chimie*, 1852, p. 643), they were accordingly named *Madar-alban*. A yellow resin associated with madar-alban in the drug was found to agree, in behaviour with reagents, with the *Fluavil* found by Payen in gutta-percha, but as regards chemical composition the madar-alban and madar-fluavil differed from the alban and fluavil of gutta-percha. Dr. Warden also separated from the drug a *yellow bitter resin*, which is probably the active principle, and *Caoutchouc*.

He found the percentage of the various principles (the results being calculated on the bark containing 8·079 per cent. of water) to be—

Madar-alban	0·640
Madar-fluavil	2·471
Black acid resin	0·997
Caoutchouc free from M.-alban and M.-fluavil	0·855
Yellow bitter resin (active principle)	0·093

The fact that the sap of the Madár plant contains in addition to Caoutchouc two principles analogous to the alban and fluavil of gutta-percha is a point of some interest, as madár gutta-percha has been recommended as a substitute for the commercial article. For full particulars of the chemical examination, see *Pharm. Journ.*, Aug. 22nd, 1885.

Toxicology.—In India Calotropis juice is used for the purpose of infanticide by the castes among which that custom prevails, being placed in the mouth of newly-born female infants. It is also, like other emeto-cathartics, sometimes taken by women to procure abortion, and a few cases are on record of its having been used for suicidal purposes. Like other irritant vegetable juices it is not uncommonly used locally to produce abortion; usually a stick is armed with cotton impregnated with the juice and an attempt is made to introduce it into the os uteri, and leave it there until uterine contractions

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are induced, but this operation often fails from awkwardness on the part of the operator, and it is not unusual to find that the stick has been forced through the uterine walls. Another method of procedure is to select a twig of the plant, and after removing the leaves and making it as smooth as possible, to introduce it into the os uteri, or failing this to allow it to remain in contact with the parts. Pessaries also, containing the irritating juice of this and other plants, are placed in contact with the uterus to induce uterine action.

Commerce.—The flowers are to be found in the shops, but not the root bark, or leaves, no doubt from the circumstance that the plant is everywhere found wild and can be collected as required.

TYLOPHORA ASTHMATICA, *W. & A.*

Fig.—*Wight Ic., t.* 1277; *Bentl. and Trim., t.* 177; *Bot. Mag., t.* 1929.

Hab.—N. and E. Bengal, Assam to Burma, Deccan Peninsula, Ceylon. The root and leaves.

Vernacular.—Jangli-pikwán, Antamúl (*Hind.*), Antomúl (*Beng.*), Nach-churuppán, Nay-pálai, Pey-pálai (*Tam.*), Pitkari, Kharakí-rásna (*Mar.*), Verri-pala, Kukka-pála (*Tel.*), Valli-pála (*Mal.*), Adumuttada (*Can.*).

History, Uses, &c.—The medicinal properties of this plant appear to have been long known to the natives of those parts of India in which it occurs, but we can find no evidence of its ever having been an article of commerce, nor are we aware of its having been described in any of the standard Hindu or Mahometan works on Materia Medica; though it may perhaps be the Antri or Antra-páchaka of Sanskrit writers. The Hindi name Antomúl is derived from *ánt,* "the entrails," and *mul,* "a root." The expression *ánt girna* signifies "to suffer from dysenteric symptoms," literally "to void the intestines." Roxburgh says of it:—"On the coast of Coromandel, the roots of this plant have often been used as a substitute

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for Ipecacuanha. I have often prescribed it myself, and always found it answer as well as I could expect Ipecacuanha to do; I have also often had very favourable reports of its effects from others. It was a very useful medicine with our Europeans who where unfortunately prisoners with Hyder Ali during the war of 1780-83. In a pretty large dose it answered as an emetic; in smaller doses, often repeated, as a cathartic, and in both ways very effectually. Dr. Russell was informed by the Physician General at Madras (Dr. J. Anderson) that he had many years before known it used, both by the European and native troops, with great success in the dysentery which happened at that time to be epidemic in the camp. The store of Ipecacuanha had it seems been wholly expended, and Dr. Anderson finding the practice of the native doctors much more successful than his own, acknowledged with his usual candour that he was not ashamed to take instructions from them, which he pursued with good success; and collecting a quantity of the plant which they pointed out to him, he sent a large package of the roots to Madras. It is certainly an article of the Hindu Materia Medica highly deserving attention." (*Flora Indica* II., 34, 35.) Ainslie states that the Vytians prize the root for its expectorant and diaphoretic properties, and often prescribe it in infusion to the quantity of half a teacupful for the purpose of vomiting children who suffer much from phlegm. From possessing virtues somewhat similar to those of Ipecacuanha it has been found an extremely useful medicine in dysenteric complaints, and has, at times, been administered with the greatest success by the European practitioners of Lower India. (*Mat. Ind.* ii., 83.) More recently we have the testimony of O'Shaughnessy and Kirkpatrick to the value of the drug as an emetic, and as a substitute for Ipecacuanha in the treatment of dysentery, and the opinion of these physicians is confirmed by the reports furnished to the Committee who superintended the preparation of the *Pharmacopœia of India*, by Drs. Bidie, Oswald, Sheriff and others. Dr. J. Kirkpatrick (*Cat. of Mysore Drugs*) says:— "I have administered this medicine in at least a thousand

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cases, and found it most valuable. In dysentery, and as a simple emetic, it is in every way comparable with Ipecacuanha. The dose is from 20 to 30 grains, with half a grain or a grain of Tartar Emetic, if strong emesis is required. If the dysentery distinctly arise from intermittent disease, Quinine is conjoined. The form of the medicine I use is the powder of the dry leaf." Tylophora is also employed in Mauritius, where it is known as *Ipeca sauvage* or *Ipeca du pays*. In the *Indian Pharmacopœia* the leaves have been made official. In the Concan 1 to 2 tolás of the juice are given as an emetic; it is also dried and made into pills which are administered in dysentery. The pills are as large as the seed of *Phaseolus Mungo*; one pill is sufficient to produce one copious stool.

Description.—The leaves are opposite, entire, from 2 to 5 inches long, ¾ to 2½ inches broad, somewhat variable in outline, ovate or sub-rotund, usually cordate at the base, abruptly acuminate or almost mucronate, rather leathery, glabrous above, more or less downy beneath with soft simple hairs. The pedicel which is channelled is ⅓ to ¾ of an inch in length. In the dry state the leaves are rather thick and harsh, of a pale yellowish green; they have a not unpleasant herbaceous smell, with but very little taste. The root consists of a short, knotty, descending root stock, about ⅙ of an inch in thickness, emitting 2 to 3 aerial stems, and a considerable number of wiry roots. These roots are often 6 inches or more in length by ½ a line in diameter, and are very brittle. The whole drug is of a pale yellowish brown; it has no considerable odour, but a sweetish and subsequently acrid taste. In general appearance it is suggestive of valerian, but is somewhat stouter and larger.

Chemical composition.—A concentrated infusion of the leaves has a slightly acrid taste. It is abundantly precipitated by tannic acid, by neutral acetate of lead or caustic potash, and is turned greenish-black by perchloride of iron. Broughton of Ootacamund obtained from a large quantity of leaves a small amount of crystals—insufficient for analysis. Dissolved and injected into a small dog they occasioned purging and vomiting.

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A re-examination of the drug by one of us (D. H.) shows that both the leaves and root contain an alkaloid, *Tylophorine*, which is crystalline and forms a crystalline hydrochlorate. The solution of the alkaloid is precipitated by tannin, iodine in potassium iodide, potassio-mercuric iodide, perchloride of mercury, picric acid, volatile and fixed alkalies. The alkaloid in a free state is very soluble in ether and alcohol, but only partially in water. With sulphuric acid it dissolves with a reddish colour changing to green and indigo. With HNO^3 it dissolves with a purplish red colour. Fröhde's reagent gives a deep sap-green solution. Sulphuric acid and $K^2Cr^2O^7$ a dirty violet. The leaves afford 15 per cent. of mineral matter.

Tylophora fasciculata, *Ham. Wight Ic.*, *t.* 848, Bhuidodi (*Mar.*), is abundant in the Southern Concan, and is used as a poison for rats and other vermin. Lyon (*Med. Juris. for India*, p. 453) records the following case in which it proved fatal to man:—" A Mahometan family, consisting of six adults and a servant-boy, æt. about fourteen, were attacked soon after a meal with symptoms of poisoning, the servant-boy died in about two hours. The others were seen the next morning, when they complained of dryness of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated that soon after taking their mid-day meal on the previous day, they felt some tingling sensation in the mouth, followed by dryness of the tongue and throat and giddiness, and loss of power over the extremities. After this they became insensible. Three of them vomited and recovered consciousness at about 8 P. M.; the other three remained insensible till midnight. On *post-mortem* examination of the body of the boy, the following appearances were noted :—Face bloated, tongue and eyes slightly protruding, veins of the neck turgid. Lungs engorged; right side of the heart full, left empty. Slight congestion of the pia mater. A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, who was at enmity with the persons poisoned, asked a friend to recommend him something to kill rats with. The friend advised

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him to use *Bhui-dodi.* On this the accused, it was reported, obtained some *bhui-dodi* roots, and having reduced them to powder, mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared. Dr. G. G. Bopardikar of Pandharpur, who kindly supplied us with the plant, states that the leaves are generally used, pounded and mixed with flour to destroy rats. On enquiry the village Vaids informed him that the juice of the root is given with milk as a tonic, and that the leaves are pounded and used as an application to unhealthy ulcers and wounds to induce healthy granulation.

T. fasciculata is an erect or scarcely twining glabrous plant, with ovate, coriaceous leaves, decreasing in size upwards. The peduncles are erect, slender and flexuous, bearing at the flexures 2 to 3 few-flowered fascicles of minute flowers. The follicles are about 2 inches in length, ovoid-lanceolate and glabrous, with a very thick pericarp. The seeds are ½ of an inch in length, broadly ovoid and quite flat. The root is thick, long and woody, from one to two inches in diameter at the crown. It is covered with a light brown corky bark, fissured longitudinally.

Chemical composition.—The leaves were very mucilaginous when treated with water, and even the alcoholic extract when evaporated to dryness made a thick solution with a large quantity of water. The latter solution was precipitated by alkaloidal reagents, and was most acrid to the taste. Shaken with ether a resinous body was removed, and then made alkaline with ammonia, which produced a slight precipitate, and again shaken with ether, a small quantity of an amorphous alkaloid was separated, which gave a yellowish brown colour with sulphuric acid, passing to a red. The leaves gave off slightly alkaline fumes when ignited, and left 12 per cent. of ash.

The roots reduced to fine powder were made into a tincture with strong spirit, and the evaporated tincture when treated with water left some resinous matter undissolved. The solu-

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tion shaken with ether yielded up some more resinous substance, which became encrusted with feathery crystals when the solvent had been dissipated. A larger quantity of alkaloid was present in the root than in the leaves, but it appeared to possess similar characters. It was amorphous, but formed a slightly crystalline hydrochloride. The damp crystals of the hydrochloride brought into contact with the fumes from a drop of nitric acid produced a bluish-green coloration. With sulphuric acid the alkaloid was first coloured reddish-brown, passing to carmine, and then to purple. It was precipitated from solution by the usual reagents.

The alcoholic extract was emetic and purgative. A quantity from 2 grams of the leaves mixed with bread and given to a chicken produced frequent and watery stools. The aqueous extract from the leaves, after removal of all that was soluble by means of alcohol, had no effect upon a guinea-pig.

DÆMIA EXTENSA, *Br.*

Fig.—*Wight Ic.*. *t.* 596; *Jacq. Ic. Rar.*, *t.* 54: *Hook. f.* in *Bot. Mag.*, *t.* 5704.

Hab—Throughout India. The leaves.

Vernacular.—Utran, Ságováni (*Hind.*), Veli-parutti, Uttamani (*Tam.*), Jittupaku, Dushtupu-chettu, Guruti-chettu (*Tel.*), Veli-paritti (*Mal.*), Utarani, Utarandi (*Mar.*), Kuntiga, Juttuve, Talavaranaballi (*Can.*), Nágala-dudheli (*Guz.*), Chhágal-báti (*Beng.*).

History, Uses, &c.—The Sanskrit name of this plant is Phala-kantaka, in allusion to its echinate follicles. The Hindi name Utran as well as the Marathi names are evidently derived from the Sanskrit *Ut-tara*, "ejecting or vomiting," and the Tamil name Dushtupu is also of Sanskrit origin, and signifies "having tainted flowers." The flowers and leaves have a fetid odour; they are used as an emetic and expectorant by the natives, especially in the diseases of children. The stems yield a fibre, and the leaves are eaten by goats. The plant

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was first fully described and figured by Jacquin; it is noticed by Ainslie under the name of *Cynanchum extensum*, who states that a decoction of the leaves is given to children as an anthelmintic, in doses not exceeding three table-spoonfuls, and that the juice is used as a remedy for asthma. Roxburgh describes the plant under the name of *Asclepias echinata*, but is silent about its medicinal properties. From the *Pharmacopœia of India* we learn on the authority of Dr. Oswald that it is used as an expectorant in the treatment of catarrhal affections, in ten grain doses, at the Pettah Hospital, Mysore. In the Southern Concan and Goa the juice of the leaves is applied to rheumatic swellings. Dr. B. Evers considers it a valuable emetic for children. He says:—"The leaves are washed and the juice expressed by rubbing them between the palms of the hands; the leaves of the dark *Tulsi* (*Ocimum sanctum*) are similarly treated, and then a mixture of the juices is given; this preparation is a stimulating emetic." Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*, Feb., 1890,) notices the use of the juice in rheumatism in combination with ginger. He also states that it is used in the preparation of a purgative medicinal oil used in rheumatism, amenorrhœa and dysmenorrhœa, and that the root-bark is used as a purgative in rheumatic cases in doses of 1 to 2 drachms mixed with cow's milk.

Description.—The leaves are roundish, cordate, acuminate, pubescent, membranaceous, auricled at the base, glaucous beneath. They vary in size from one to two inches or more in diameter; the peduncles are long, slender and hoary. The plant has a disagreable mouse-like odour and a faintly bitter and somewhat nauseous taste; examined with a lens both the upper and under sides of the dry leaf present a green mossy surface, thickly studded with short white hairs. The flowers are dull white and drooping, the follicles have a curved beak, and are covered with soft bristles.

Chemical composition.—The leaves of *D. extensa*, like those of Tobacco and Adhatoda, evolve alkaline fumes when ignited, and like them contain an alkaloid. The alkaloid, which we

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have provisionally named *Dæmine,* is soluble in ether, alcohol and water, and shows no disposition to crystallize from these and other solvents. In contact with strong sulphuric acid it dissolves with a reddish-violet colour, gradually fading; with Fröhde's reagent it gives a yellowish brown coloration. It forms crystalline deliquescent salts very soluble in water, with a bitter taste. An alkaloid having similar properties was separated from a sample of the root. The ash from a sample of the dried and powdered leaves amounted to 15·33 per cent.

DREGEA VOLUBILIS, *Benth.*

Fig.—*Wight Ic.*, *t.* 586; *Rheede Hort. Mal. ix.*, *t.* 15, var. *Lacuna*; *Dcne. in Jacq. Voy. Bot.* 108, *t.* 114.

Hab.—Bengal, Assam, Deccan Peninsula, Ceylon. The root, herb, and fruit.

Vernacular.—Nakchikni (*Hind.*), Titakanga (*Beng.*), Hirandodi, Ambri (*Mar.*), Kodi-palai (*Tam.*), Dudhi-palla (*Tel.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit writers; it is the *Watta Kakacodi* of Rheede, who states that the root is applied to snake-bites and given to women to cure headache after child-birth; and the *Kodie palay* of Ainslie (*Mat. Ind.* ii. 154), who remarks that "The root and tender stalks are supposed by the Vytians to possess virtues in dropsical cases; they sicken, and excite expectoration; though I could not obtain much information of a certain nature respecting them; it is to be presumed that they operate in a manner somewhat similar to the root of the *Asclepias curassavica.*" The leaves are much employed by the Hindus as an application to boils and abscesses to promote suppuration, and the brown mealy substance with which the follicles are covered is applied to the galls and sores of draught cattle. The plant is noticed in the secondary list of the *Pharmacopœia of India.* The variety *Lacuna* is preferred for medicinal use by the natives. Irvine (*Mat. Med., Patna*), says the plant is used in colds and eye-diseases to cause

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sneezing, whence the Hindi name Nakchikni. This property of the plant is also known in Madras, where the young shoots are cut and the exuding juice inserted into the nose. The follicles are frequently eaten by the natives in their curries, the process of boiling or cooking removes their bitterness and nauseating property.

Description.—A stout tall climber, branches often pustular, bark of the woody parts smooth, ash-coloured. Leaves 3 to 6 by 2 to 4 inches, rather coriaceous, base rounded or cordate; nerves 4 to 5 pairs; petiole 1 to 3 inches. Peduncles 1 to 3 inches, rather slender; umbels drooping, multifid, subglobose; pedicels ½ inch, slender, corolla ½ inch in diameter, cupular, lobes triangular. Stigma dome-shaped. Follicles horizontal, obtuse, about 3 to 4 inches long, and four in circumference at the base. In the variety *Lacuna* all parts of the plant, but especially the follicles, are covered with a brown mealy substance, which consists of moniliform hairs made up of cylindrical cells placed end to end. They can be well examined under the microscope with potash solution which colours them yellow.

Chemical composition.—The fresh follicles, freed from seeds and their comose appendages, were bruised in a mortar and the juice expressed. The juice was heated to boiling to coagulate albuminous matters and filtered, and the liquor, after evaporation to a small bulk, was treated with two volumes of spirit to remove mucilage and salts. After dissipating the spirit by a gentle heat, the acidulous solution had a bitterish taste, was free from tannic matters, and contained an abundance of glucose. It was shaken with ether, and the ethereal solution left a mass of light-coloured transparent scales, soluble in water with a peculiar bitterish-sweet taste and neutral or slightly acid reaction. This solution gave an abundant white precipitate with tannin, none with neutral plumbic acetate; and with alkaloidal reagents, such as potassio-mercuric iodide and iodine in potassium iodide, only if previously acidified. With strong aqueous alkali a precipitate, without colour,

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was obtained. With sulphuric acid the dried scales dissolved with a brown colour, passing through cherry-red to purple, and finally separated as a black powder. With nitric acid no colour was manifested in the cold. Boiling with diluted acid destroyed the bitterness of the principle, with the formation of an insoluble brown substance, such as would attend the decomposition of a glucoside. We consider this glucoside to be the active principle of the fruits, and propose to name it *Dregein.*

HEMIDESMUS INDICUS, *Br.*

Fig.—*Wight Ic.*, *t.* 594 ; *Rheede Hort. Mal. x.*, *t.* 34 ; *Bentl. and Trim.*, *t.* 174. Indian Sarsaparilla (*Eng.*), Salsepareille de l'Inde (*Fr.*).

Hab.—Northern, Western, and Southern India. The roots.

Vernacular.—Anantamul (*Hind.*, *Beng.*), Upersára, Dudha sáli (*Mar.*), Nannári (*Tam.*), Sugandhi-pála (*Tel.*), Sogadé, Karibanta (*Can.*), Upalsári (*Guz.*).

History, Uses, &c.—Dutt. (*Hind. Mat. Med.*, p. 195) states that in Hindu medicine *H. indicus* and *Ichnocarpus frutescens* (see Apocynaceæ) are both called Sáriva, and are described under the name of Sárivadvaya, or the two Sárivas. They are often used together, and are considered to have similar properties. When however Sáriva is used in the singular number, it is the usual practise to interpret it as meaning *I. frutescens.* Other Sanskrit names for these plants are Nága-jihva, "snake's tongue," and Gopa-kanga, "cowherd's daughter." *H. indicus* is distinguished as Utpala-sáriva. The Hindus consider them to be demulcent, alterative and tonic, and prescribe them in dyspepsia, skin diseases, syphilis, fever and dysentery; they are generally combined with bitters and aromatics. Under the name of Nannári, Hemidesmus is much used in Southern India, but in the northern part of the Bombay Presidency, though a common plant, it is seldom obtainable in the bazaars, imported sarsaparilla being offered when inquiries are made for it. In the more southern parts of the Concan

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the milky juice is dropped into inflamed eyes; it causes copious lachrymation, and afterwards a sensation of coolness in the part. The root is tied up in plantain leaves and roasted in hot ashes; it is then beaten into a mass with cumin and sugar and administered with *ghi* as a remedy in heat or inflammation of the urinary passages. As a *lep* the root is applied to swellings. It is used in Madras in mixtures for purifying the blood as ordinary Sarsaparilla is in other countries, and it is an adjunct in chutneys and pickles simply as a flavouring agent.

Recent Mahometan physicians under the name of *ushbah* describe several kinds of sarsaparilla, of which they say the Western or Andalusian is the best. Another kind is described by the author of the *Makhzan-el-adwiya* as having flowers like yellow jasmine; this may possibly be Hemidesmus. The authors of the *Pharmacographia* remark that there is an Indian root figured as *Palo de Culebra* by Acosta (*Tractado de las Drogas de las Indias orientales*, 1578, *cap. LV.*) which is astonishingly like the drug in question. He describes it, moreover, as having a sweet smell of melilot. The plant he says is called in Canarese *Duda-sáli.* The figure is reproduced in Antoine Colin's translation, but not in that of Clusius. This plant must be the true Hemidesmus, as *Dudha-sáli* is a name it is known by in the Concan. In Goa at the present day Hemidesmus root is to be found in all the shops; it is known to the Portuguese as *Uperçao,* an evident corruption of the Maratha name. Ashburner in 1831 was the first to call the attention of the profession in Europe to its medicinal value, and in 1864 it was made official in the British Pharmacopœia. In India O'Shaughnessy found its diuretic action to be very remarkable; two ounces infused in a pint of water and allowed to cool was the quantity usually employed daily, and by such doses the discharge of urine was generally trebled or quadrupled. It also acted as a diaphoretic and tonic, and so increased the appetite that it became a most popular remedy in his hospital, the patients themselves entreating its administration and continuance. (*O'Shaugh-*

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nessy, Dispensary, p. 456, *Beng. Pharm.*, p. 279—301). In 1868, Hemidesmus was made official in the *Pharmacopœia of India*. Lastly, in 1874, it was described by Flückiger and Hanbury in the *Pharmacographia*.

Description.—The drug is found in commerce in India in the form of little bundles, which consist of the entire roots of one or more plants, often several feet long, tied up with a portion of the stem.

The root is cylindrical, tortuous, from $\frac{2}{10}$ to $\frac{7}{10}$ of an inch in diameter, seldom branched. The bark is transversely cracked and fissured longitudinally, of a dark brown colour, sometimes with a slight violet hue when viewed in a strong light; the wood is yellow and porous. The fresh or freshly-dried root has a fine odour of tonka bean or melilot, and a sweet but slightly acrid taste.

Microscopic structure.—According to Flückiger and Hanbury, all the proper cortical tissue shows a uniform parenchyme, not distinctly separated into liber, medullary rays and mesophlœum. On making a longitudinal section, however, one can observe some elongated laticiferous vessels filled with the colourless concrete milky juice. In a transverse section, they are seen to be irregularly scattered through the bark, chiefly in its inner layers, yet even here in not very considerable number. They are frequently 30 mkm. in diameter and not branched.

The wood is traversed by small medullary rays, which are obvious only in the longitudinal section. The parenchymatous tissue of the root is loaded with large ovoid starch granules. Tannic matters do not occur to any considerable amount except in the outermost suberous layer.

Chemical composition.—The aroma and taste of the drug is due to the presence of coumarin (see Vol. I., p. 406), which can be obtained in part by boiling the root with water. Crystals of coumarin can be prepared from the residue after distillation by drying and extracting with alcohol. This is no

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doubt the substance obtained by Garden in 1837, and called smilasperic acid, and subsequently by Scott in 1843, who described it as a crystalline stearopten.

Commerce.—In Southern India and Bengal the root is met with in commerce, but is often so old as to be quite worthless. In Bombay arrangements have to be made for its collection, which costs Re. ¼ per lb., owing to the difficulty of digging the roots in stony ground.

COSMOSTIGMA RACEMOSUM, *Wight.*

Fig.—*Wight Ic., t.* 591, 1270; *Rheede Hort. Mal. vii. t.* 32.

Hab.—Sylhet, Chittagong, W. India, Ceylon. The root and leaves.

Vernacular.—Ghárahuvvu (*Can.*), Shendvel, Shendori, Márvel, Márvivel (*Mar.*), Vattu-valli (*Mal.*), Ghárphúl (*Goa.*).

History, Uses, &c.—This large woody climber running over high trees, has a medicinal reputation on the Western Coast, where its leaves are used to cure ulcerous sores Ghára (घाड) and the root bark is administered internally in Vataka (वटक), a disease in which white lumps of undigested food are passed. Rheede is the only European writer who notices its medicinal properties; he states it is called *Torique* by the Portuguese and *Pensbout* by the Dutch; after mentioning the use of the leaves, he remarks: "Cortex cum Sandalo et muliebri lacte in formam noduli adhibitus, præstantissimum *Causonis* remedium est." The disease he alludes to is the καυσος of the Greek physicians, and is described by Paracelsus as characterised by pungent heat internally, great heat of breath, desire of cold air, dryness of the tongue, lips, and skin, coldness of the extremities, the urine loaded with bile, watchfulness, and a quick, small and weak pulse. In modern medicine we should describe it as dyspepsia accompanied by a febrile condition and absence of bile in the stools. We have tried the root bark of this plant in such cases, given in five grain doses three times a day, and have found it to be a most efficient cholagogue; it had no purgative effect, but restored the natu-

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ral colour of the stools after the usual remedies (mineral acids, podophyllin, euonymin, &c.,) had been abandoned in despair. The flowers of this plant are sweet and are eaten by the natives. A biscuit was made with the powder of two ounces of the root and given to a dog without any ill effects.

Description.—Leaves large, rather coriaceous, smooth, ovate-cordate, acuminate, but sometimes rounded with an obtuse tip, readily distinguished by a group of small, brown, dusty, prominent glands at the junction of the petiole with the leaf. Roots from ¼ to 1 inch in diameter, externally light brown and scabrous; fracture starchy and friable, a transverse section shows them to be composed of a central woody column and a very thick greyish-white cortex. In the circumference, and sparingly scattered through the root, light yellow brown hard cells are seen. The root has no taste, and a faint Ipecacuanha-like odour, which is more marked in the seeds. The latter are contained in a large, smooth, green follicle.

Chemical composition.—An ether extract of the powdered root contained some free, crystalline fatty acids, soluble in cold rectified spirit and aqueous alkalies. Petroleum ether dissolved the fatty acids from the extract, leaving a small quantity of an acid resin. An alcoholic extract, in addition to a resin, contained a sugar, and a substance affording the reactions of an alkaloid. The resin is decomposed by boiling with dilute acids, and gives a purplish colour with strong sulphuric acid. It is glucosidal and is related to jalapin. An aqueous extract contained gum and a carbohydrate having the properties of dextrin. The root was devoid of astringency. The powder mixed with milk of lime gave off ammonia. The larger roots left 3·16 per cent., the smaller ones 5·86 per cent. of inorganic matter on incineration.

GYMNEMA SYLVESTRE, *Br.*

Fig.—*Wight Ic., t.* 349.

Hab.—Banda, Deccan Peninsula. The leaves and root.

Vernacular.—Mera-singi (*Hind., Beng.*), Kavali, Vákhandi (*Mar.*), Siru-kurinja (*Tam.*), Sanna gerse (*Can.*).

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History, Uses, &c.—This shrubby climbing plant is called Meshasringi, "ram's horn," in Sanskrit, but it is not mentioned in the Raja Nirghanta. It is considered to be the Meshasringi of Madanpal's Nighanta and of the Marathi and Guzerathi Nighantas, which are little more than translations of that work. It bears the following synonyms—Mesha vishánika, Meshavalli, Sarpa-darushtrika, Anyáda, Kshina-vartta, Vrikshikáli and Vishánika, and is described as having a pungent taste and the properties of an astringent and bitter stomachic; useful in cough, biliousness, boils, sore eyes, &c.

It is also in repute amongst the Hindus as a remedy for snake bite, the powdered root being applied to the part bitten, and a decoction administered internally. Its use for this purpose is well known to the natives of the Concan, and as appears from Ainslie (*Mat. Ind.* II., 390), also to the natives of Southern India. The root is also said to have virtues similar to Ipecacuanha. Roxburgh describes the plant under the name of *Asclepias geminata*, and remarks that the small yellow flowers, with the globular apex of the white common stigma, projecting in the centre, look like fine pearls set in gold. He says nothing of its medicinal properties. *G. sylvestre* is said to be the *binnuge* of the Cingalese. A curious circumstance connected with this plant was first noticed by Mr. Edgeworth, namely, that if chewed it destroys the power of the tongue to appreciate the taste of sugar and all saccharine substances. This property of the leaves has been recently (1887) tested carefully by Mr. D. Hooper, who says:—" After chewing one or two leaves it was proved undoubtedly that sugar had no taste immediately afterwards. Sugar in combination with other compounds in dietetic articles is plainly destroyed as to its taste after using these leaves. In ginger bread, for instance, the pungency of the ginger is alone detected, the rest is tasteless meal; in a sweet orange the taste of the sugar is so suppressed and that of the citric acid consequently developed, that in eating, it resembles a lime in sourness. Among the several kinds of foods, drugs and beverages which affect the palate, *Gymnema* does not pretend to render them all taste-

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less, it does not affect pungent saline things, astringents and acids. It is limited to apparently two diverse substances—sweets and bitters. It has been noted that sugar taken after the leaf tastes like sand, so I have found that sulphate of quinine taken after a good dose of the leaf tastes like so much chalk. I am not going to propose its use in the administration of nauseous drugs, until the medical properties of the *Gymnema* have been more studied, otherwise the quantity of the vehicle taken may prove to counteract the effect of the medicines. The experience of several friends as well as my own is that the effect does not last for twenty-four hours as stated, but for only one or two hours, after that time the tongue resumes its appreciation of all that is sweet or bitter." In the Concan the dried and powdered leaf is used as an errhine, and the fresh leaves crushed and mixed with water, as a cooling bath for children in the hot weather.

Description.—*G. sylvestre* is a shrubby climbing plant. The leaves are from 4 to 5 inches long, from ovate-lanceolate to obovate; upper surface dark green, shining, under surface pale green, shortly pubescent; venation transverse and reticulate with a marginal vein; taste saltish and acrid. The root is about the size of the little finger or less, not unlike *Hemidesmus*; it has a tough wood, and when fresh a soft spongy bark, which is reddish brown and fissured longitudinally, but loses much bulk in drying, and becomes loose and transversely fissured; the taste is acrid and saltish; the whole plant abounds in milky juice.

Microscopic structure.—The woody portion of the root has a radiate structure, and is traversed by large vessels; the extension of the medullary rays into the bark is distinct; the latter is made up of a thin-walled parenchyma, the cells of which contain much starch and tolerably numerous crystalline concretions. There are many laticiferous vessels, especially towards the inner part. The epidermis consists of several layers of flattened cells of a deep reddish brown colour.

Chemical composition.—The powdered leaves were submitted to the action of various solvents, and by this means it was ascertained, that the peculiar property of *Gymnema* leaves was

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dissolved out by alcohol, and, as it occurred in the aqueous extract of the residue, it was therefore soluble in water. As benzine and ether took from the leaves certain principles of the same appearance and weight, it was conceived that nothing would be gained by using both solvents; the preliminary extraction was therefore made with rectified spirit. The ether extract consisted of chlorophyll and two resins separated by their solubility in alcohol. The resin insoluble in alcohol formed the larger portion; it was soluble in chloroform, bisulphide of carbon and benzine. It was elastic and tenacious, decomposed by warming with nitric acid, the product being precipitated with water; only partially saponified with caustic potash. Sulphuric acid dissolved it in the cold, giving a green solution. It seemed to consist principally of a neutral resin. The resin soluble in spirit was readily saponified with soda, and gave a permanent bluish green colour with sulphuric acid; like the former resin it was of an acrid nature, and left a tingling sensation in the throat. The alcoholic solution of the leaves was almost entirely soluble in water; in fact, by treating the leaves separately by alcohol and water, 36·37 per cent. of organic matter was extracted, by treating the drug with water alone 36 per cent. was removed. By direct experiment it was found that in the former extract 0·74 per cent. was an acrid resin similar to those found in the ether extract. The aqueous solution of the substances soluble in alcohol had a decidedly acid reaction, it gave no colouration with ferric chloride, showing absence of tannin. It was deepened in colour with alkalies, but gave a bulky precipitate with sulphuric, nitric, hydrochloric and acetic acid. It reduced Fehling's solution on boiling, and gave a cloudiness with Nessler, a precipitate with lead acetate, but none with tannin or picric acid. The precipitate caused by sulphuric acid was collected on a filter and washed till it ceased to give a cloudiness with barium chloride. It yielded a greenish powder, insoluble in water, but soluble in alcohol, ether, benzine and chloroform. With potash, soda and ammonia it afforded fine red solutions with orange coloured froth, but they were both

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precipitated on the addition of the mineral acids. It dissolved in concentrated sulphuric and nitric acids with intense red colour, but in both mixtures it was destroyed and precipitated by water. It fused at about 60° C. into a blackish brittle mass. Heated in a test tube it gave off fumes of creasote, but no crystals were obtained in a subliming apparatus. Gently ignited it burnt with a bright flame, leaving no ash. It was thrown down as a bulky grey mass by acetate of lead, the lead salt decomposed by sulphuretted hydrogen in spirit left the substance in the reddish evaporated filtrate from the lead sulphide. The body just described has the characteristics of an organic acid related in some particulars to glycyrrhizic acid, but having some distinctly peculiar reactions and possessing the antisaccharine property ascribed to the leaves, I propose to call it *Gymnemic Acid.* Gymnemic acid forms more than six per cent. of the constituents of Gymnema leaves in combination with a base which is inorganic. It is a monatomic acid, having the formula, $C^{32} H^{55} O^{12}$, and requiring theoretically 14·63 per cent. of metallic silver and 15·20 per cent. of PbO for its silver and lead salts. It forms insoluble salts with alkaloids, and this accounts for its masking the taste of quinine. The acid is a glucoside. After boiling for about an hour with dilute hydrochloric acid, a dark resinous mass, devoid of the peculiar property of the leaves, remains, and the liquor contains a body which readily reduces Fehling's solution and crystallizes when evaporated. Another organic acid was present in the lead acetate precipitate, which was identified as tartaric acid. The filtrate from the insoluble lead compounds was treated with sulphuretted hydrogen gas, and the clear liquor after evaporation was examined for sugar. Glucose was detected in some quantity by its immediate and abundant reduction of Fehling's solution; the sugar examined in a polariscope had a left-handed rotation. Chloroform agitated with an alkaline solution of the leaf left a crystalline residue of a brownish colour; it had a bitter taste, and acted as a sialagogue. With the ordinary alkaloidal reagents it afforded coloured precipitates, but was a neutral principle.

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A solution of one per cent. hydrochloric acid was employed to remove the oxalate of calcium; a microscopical examination of the powdered leaves showed a fair sprinkling of the conglomerate crystals or raphides so well known to exist in Rhubarb. The dilution of the acid menstruum rendered this process very tedious, so a stronger acid was used, and the marc washed with it until ammonia produced no cloudiness. The collected liquors were allowed to deposit, the sediment was then collected on a filter, dried and weighed, then incinerated and weighed again. The calcium carbonate was calculated into oxalate, and the difference between this and the first weighing was reckoned as pararabin. No oxalic acid was found in a free state. The ash of *Gymnema sylvestre* is very high, a fact in accordance with the amount of lime salts it contains. Gentle ignition of the air-dried leaves left as much as 11·65 per cent. and about one-half of this was calcium carbonate. One hundred parts contained:

15·41 soluble in water.
78·71 soluble in acid.
5·88 sand and siliceous residue.

The following is a tabulated analysis of the sun-dried and powdered leaves;—

Ether extract (chlorophyll and resins)		5·51
Alcoholic extract (gymnemic acid, tartaric acid, glucose, neutral bitter principle, resin, &c.)		19·50
Aqueous extract (gum 1·45 per cent., glucose, carbohydrate and extractive)		16·87
Alkaline extract, by difference (albuminous and coloring matters)		8·15
Acid solution	Calcium Oxalate	7·44
	Pararabin	7·62
Ash (balance of)		5·69
Cellulose		27·86
Moisture		6·04
		100·00

—(*Hooper in Pharm. Journ.*, April, 1887, and *Chem. News*, April, 1889.)

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CEROPEGIA BULBOSA, *Roxb.*

Fig.—*Roxb. Cor. Pl.* i., 11, *t.* 7; *Wight Ic., t.* 845; *Hook. Bot. Misc.* ii., 99; and *Suppl. t.* 2.

Hab.—From Western India, the Punjab and Upper Gangetic plain as far east as Allahabad, southwards to Travancore.

Vernacular.—Mánchi, Manda (*Tel., Tam.*), Gálot (*Punj.*), Khapparkadu, Gáyala (*Mar.*).

History, Uses, &c.—Several forms of this variable plant are described in the *Flora of British India* with leaves from nearly orbicular to linear-lanceolate. Roxburgh remarks that every part of the plant is eaten by the natives, either raw or stewed in their curries. Edgeworth and Dr. J. L. Stewart have recorded its use as a vegetable in the Punjab and at Mooltan, and in the *Materia Medica of Western India* it is stated that shepherds are fond of the tubers, which they consider to be tonic and digestive. R. Brown notices the use of *C. juncea* as a vegetable, and we have also observed that *C. tuberosa* is not distinguished by the natives from *C. bulbosa*. On the Nilgiris the tubers of *C. pusilla* are known as "Chutlan-killangu," and are much appreciated as an article of diet.

The tubers when boiled lose their bitterness, and pulped with milk form a sweet mucilaginous mixture not unlike salep, which, judging from their chemical composition, should be highly nutritious.

Description.—Root tuberous, a little flattened like a turnip, with several fibres from its base; it is about as large as a small apple. Stems twining, herbaceous, smooth, succulent; from 2 to 4 feet long. Leaves opposite, short petioled, obovate with a small point, entire, fleshy; size various. Umbels lateral, length of the leaves, peduncled, few-flowered. Flowers pretty large, erect, tube greenish, border purple. Follicles two, slender, singly, about 3 or 4 inches long. (*Roxburgh.*)

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Chemical composition.—The tubers yielded on analysis—

Moisture	5·25
Fat	3·30
Sugar, gum, &c.	23·40
Albuminoids	3·48
Starch	42·52
Crude fibre	12·64
Ash	9·43
	100·00

The bitter principle of the tubers is an alkaloid, *Ceropegine*, soluble in ether, alcohol and water. The total nitrogen afforded by burning with soda-lime was 0·55 per cent. The ash contains manganese, and is constituted as follows :—

Soluble in water	61·7
Soluble in acid	14·9
Insoluble	23·4
	100·0

Caralluma attenuata, *Wight Ic., t.* 1268, Pulambari (*Tel.*), is used on the Eastern coast for ostensibly regenerating stale toddy. From information received from an Abkari Inspector, it appears that the bruised fresh plant is added to toddy to increase its gravity, and to give it the appearance and smell of that recently drawn. The toddy may be several days old, but so complete is the process of renewal that experienced judges are often deceived. The plant is acrid and bitter, and contains a caoutchouc-like substance, a resin similar to fluavil and a bitter principle, and so far resembles the Calotropis.

The Sanskrit names Kshiri, Kshirini, Kshira-kshava, Dugdha, Dugdhika, Dugdhapáshána, &c., are loosely applied to a number of milky plants, but more especially to the edible Asclepiads, such as **Oxystelma esculentum, Holostemma Rheedii, Caralluma edulis** and **fimbriata.** These plants as well as other Asclepiads are also called Yugmaphalottama, and Uttama-phalini, in allusion to their "twin

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pods," which are favourite vegetables of the Hindus. The central portion of the flowers of **Holostemma Rheedii, Cosmostigma racemosum**, and **Periploca aphylla** is sweet and is eaten by the natives. The acidulous and somewhat bitter stems of **Caralluma edulis** are eaten as a vegetable in the Punjab. The roots of **Holostemma Rheedii, Pentatropis spiralis** and **microphylla**, and the follicles of **Marsdenia Roylii** are considered to be cooling, and alterative, and are used in alterative decoctions and as a remedy in gonorrhœa. **Sarcostemma brevistigma** yields an abundant bland milky juice; this plant and **Periploca aphylla** are used as substitutes for the *Soma* of the Vedas, which from recent investigations appears to have been a species of *Ephedra*, and the same plant which is still brought from Persia to India as the *Homa* of the Parsis. **Stapelia reflexa** is used by the Afghan mountain tribes as a bitter tonic and febrifuge, and **Boucerosia Aucheriana** is considered to have similar properties. Dr. G. Bidie has shown that **Secamone emetica**, notwithstanding its specific name, is almost inert.

LOGANIACEÆ.

STRYCHNOS NUX-VOMICA, *Linn.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 243; *Bentl. and Trim.*, *t.* 178; *Gärtn. Fruct.* ii. *t.* 179; *Rumph.* i. t. 25; *Rheede Hort. Mal.* i., t. 37. Poison-nut, False Angostura bark (*Eng.*), Vomiquier (*Fr.*).

Hab.—Throughout tropical India. The stem, bark and seeds.

Vernacular.—Kuchila (*Hind, Beng.*), Kájra (*Mar.*), Yettie-kottai (*Tam.*), Mushti-vittulu, Mushidi (*Tel.*), Hemmushti (*Can.*), Kannirakkuru (*Mal.*), Bidara-laut (*Malay*).

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History, Uses, &c.—No mention of Nux-vomica can be found in the older Sanskrit medical works. A drug called Vishamushti, mentioned by Sarangadhara, has by some been supposed to be nux-vomica, but according to the Bhavaprakasha, Vishamushti has an edible fruit, and is called Karerua in Hindi. The latter work gives Kupilu and Kulaka as Sanskrit names for Kuchila, but these names are generally referred to a kind of ebony. Another Sanskrit name given to the drug in recently compiled works is Kurachilla, an incorrect form of Kuruchilla, "a crab," to which animal the seeds bear some resemblance in shape. We think there can be little doubt that nux-vomica was not used medicinally by the ancient Hindus, but the Hindi name Kuchila or Kuchula occurs in ancient Persian, and appears to be derived from the Sanskrit कुञ्च् (kunch) to make crooked. We also find an unidentified plant called Kuchela, mentioned by Sanskrit writers, with the synonyms of Avi-karni and Viddha-parni; the name Kuncha-phala is also met with, but it may possibly be only an incorrect rendering of Kucha-phala, a term for the pomegranate. We can hardly suppose that a plant having such marked poisonous properties can have escaped the notice of the earliest settlers in India, and there can be no doubt that the wood has been in use from a very early date as one of the kinds of Mushadi in Southern and Western India. We also find that in the Indian Archipelago, which was colonised at a very early date by the Hindus, the wood is used as a popular remedy for dysentery, fevers and dyspepsia, under the name of Bidara-laut by the Malays. This name appears to be of Sanskrit origin and to be derived from Vidara, "splitting or rending," and lata, "a tree or shrub," in allusion to the tetanic spasms produced by over-doses of the drug.

In the Rájá Nirghanta two kinds of Katuka are noticed; one of these with the vernacular synonym Kedár-katuki is doubtless *Picrorhiza Kurroa*, the other Katukavalli with the Canarese synonym Tonrematta, which does not appear in the vernacular Nighantas, must, we think, be referred to the bitter woods used as lignum colubrinum. (See *Strychnos colubrina.*)

It has been supposed by some that nux-vomica was the Jouz-el-máthil of the early Arabian writers, but this drug is described by Ibn Sina as studded with thick thorns, and as producing torpor when eaten; it is considered by all the more recent Mahometan writers to be Datura. The Jouz-el-kai of the Arabs has also been supposed to be nux-vomica, but there would seem to be no foundation for such a belief, as it is described as having properties similar to Jouz-el-máthil, and is probably the fruit of a Trichilia. All the Indian Mahometan physicians describe nux-vomica under the name of Azáráki; of this drug Ibn Sina merely says it is a kind of Zabad-el-bahr (foam of the sea), a name given by the Arabs to the cuttle-fish bone; he adds that it is not used internally, but applied externally in skin diseases and sciatica. Haji Zein-el-Attár (A.D. 1368) is the first who clearly identifies *Azârâki* with the Indian drug *Kuchula*; he gives the same description of its uses as Ibn Sina, and says the antidotes for it are fresh milk and oil (these are the popular antidotes for it at the present day in India, but in Madras dog excrement is also used). In the Makhzan-el-adwiya *azáráki* is said to be a Syrian word, but it appears to us more probable that it has been manufactured by the Syrian physicians, who instructed the Arabs in Greek medicine, from the words ἄζα and ῥαχία, and that it intended to be a Greek rendering of the Arabic Zabad-el-bahr. The author of tht Makhzan gives *Kuchila* as the Indian Indian name for nux-vomica, but says it is best known in Hindustan (Northern India) as Nirbhedin (a Sanskrit word which signifies splitting asunder, derived from निर्भिद), Nux-vomica is not mentioned by Garcia d'Orta who was in Goa, where the tree is very common, about the middle of the 16th century—a tolerably clear proof that it was not used medicinally at that time—but his contemporary Valerius Cordus in Europe describes it accurately. The seeds do not appear to have been used medicinally until about the middle of the 17th century, but Rheede mentions the root as an established remedy in Malabar, and we have much earlier records of its use on the Western Coast as a substitute for the true *Lignum Colubrinum*, a drug

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held in high estimation as a tonic, antiperiodic and alexipharmic in Southern India under the name of Nágamushidi. On the whole we are of opinion that the Arabs were acquainted with nux-vomica seeds under the name of *azárákí*, but that they imagined them to be of marine origin,—a comparatively modern Arabico-Persian name for them is Fulús-mahi ("fish scales"); this is the more likely, as the tree is especially a native of the Western and Southern Coast districts of India, and the seeds like those of several other plants are liable to be carried to a distance by oceanic currents.

Ainslie speaks of nux-vomica as a drug which is little used; he rightly states that the pulp of the fruit is poisonous, and the authors of the *Pharmacographia* have since shown that it contains strychnine; nevertheless it is eaten by the hornbill and other birds. He also tells us that the Vytians are of opinion that if the seeds are not taken in sufficient quantity to cause death, they will produce mental derangement. Loureiro states that the seeds roasted to blackness are really useful, and can be given without danger in *fluor albus*. In the Concan small doses of the seeds are given with aromatics in colic, and the juice of the fresh wood (obtained by applying heat to the middle of a straight stick to both ends of which a small pot has been tied) is given in doses of a few drops in cholera and acute dysentery. In some districts small quantities of the seeds are taken, apparently as a stimulant, or in lieu of opium. They also enter into the composition of the *bakha* pills, used in the preparation of Mahwa and other country spirit (see *Bassia*). In European medicine strychnine is usually preferred to the crude drug in which the proportion of alkaloid varies considerably. In 1883 Professor Bentley drew attention to this fact as affecting the strength of the extract, stating that he had suffered serious personal inconvenience from the variation in strength of extracts prepared from different kinds of seed. This statement led to the examination of five samples of commercial nux-vomica by Messrs. Dunstan and Short, who found that the proportion of alkaloid contained in them ranged from 2·56 to 3·57 per cent. Subse-

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quent experiments conducted by Dr. Schweissinger showed that the German official preparations varied considerably in strength, he therefore proposed that the strength of the tincture should be fixed at 0·2 per cent. of alkaloid; and that of the extract at 15 per cent., which would practically agree with the standards adopted in the new *British Pharmacopœia*. It must be borne in mind, however, that the tincture and extract of nux-vomica contain brucine and other constituents, and that therefore its medicinal action may differ from that of strychnine; indeed they are considered by some to be more efficient than that alkaloid in atonic dyspepsia.

H. Beckurts (*Arch. der Pharm.*, 1890, 330—347) remarks that if the physiological action of strychine and brucine is as given by Falck 1 : 38·5, then little is accomplished by a total alkaloid determination; it would be more to the point to require a fixed percentage of strychnine and disregard the brucine (of which an equal quantity could always be assumed). An extract with fixed strychnine percentage and a brucine percentage varying within 1·8 per cent. is undoubtedly more reliable than an extract containing a fixed quantity of total alkaloid in which the strychnine present might vary 1·8 per cent.

Beckurts obtained the following alkaloidal percentages from nine samples of nux-vomica:—Bombay, 2 samples, 2·33 and 2·30 per cent.; Malabar, 1 sample, 2·66 per cent.; Cochin, 3 samples, 2·51, 2·41 and 2·81 per cent.; Madras, 2 samples, 3·42 and 1·53 per cent.; Calcutta, 1 sample, 2·40 per cent. In a total of ten determinations made, assuming strychnine and brucine to be present in equal proportion, the yield of strychnine varied between 2·17 and 2·38 per cent.

Physiological action.—Nux-vomica affects animals very unequally. Cold-blooded animals are destroyed by it, but there is a considerable difference of opinion regarding its physiological action upon serpents and fish. The frog is affected with tetanic spasms if $\frac{1}{1000}$ of a grain of strychnine in solution is applied to its back, previously dried so as to impede the elimination of the

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poison through the integument. It is well known in India that birds are comparatively insusceptible to the poison, and large doses of nux-vomica may be given to fowls without any injurious effect. Ruminating animals are less easily affected by strychnine administered with the food than other quadrupeds; dogs and rabbits are soon destroyed by it, whilst certain monkeys and some other animals are said to be comparatively insusceptible to its action. Injected into the circulation it probably affects all animals alike. Stillé and Maisch remark:—"The phenomena in the various cases in which its specific operation is developed consists of tremor, twitchings, and startings of the voluntary muscles, followed by tetanoid spasms, during which the heart's action is accelerated, the temperature raised, and the respiration and consciousness suspended. Between the spasms the circulation generally becomes normal, the consciousness returns, and cutaneous hyperæsthesia is observed, but the spasms may be renewed by any excitation, as a touch, a loud sound, or a sudden impression on the eye. Death may occur through asphyxia from tonic spasm of the respiratory muscles, by syncope, or by exhaustion. The heart continues to pulsate after the respiratory movements have ceased. Of these modes of death, that during spasm is by far the most frequent in cases of strychnine-poisoning. No lesion is uniformly found after death; the heart may be distended with black blood or empty, and, although congestion and serous effusion within the meninges of the brain and spinal cord are usual, they are not uniformly met with, and in the substance of these organs no characteristic alterations have been observed. Falck experimented on rabbits with brucine nitrate injected subcutaneously in doses from ·1 gram. to ·02 gram. per kilogram of body weight. He found that the symptoms induced might be arranged in three divisions:—

1st—Respiration is quickened, and in some cases a strange injection of the ear was noted: the pupils may be dilated,

2nd—Tetanic convulsions, trismus, opisthotonos, oppressed respiration and dilated pupils.

3rd—Moribund.

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According to Falck the minimum lethal dose for rabbits is ·023 gram. per kilo of body-weight. Strychnine kills 3·06 times quicker, the intensity of the action of strychnine relative to brucine being as 1 to 117·4. (*Vierteljahrsschr. f. Gerichtl. Med., Band.* xxiii., p. 78, quoted by *Blyth on Poisons.*)

The experiments of Dr. W. H. Klapp (1878) led him to conclusions which may thus be summarized: 1, Strychnine produces no primary lesion of the nerve-substance proper. 2. Its convulsions are not cerebral. 3. It does not affect either the sensory or motor nerves at their periphery. 4. These nerves are unaffected by it in their course. 5. Its tetanizing effects depend upon its action on the gray matter of the spinal cord. 6. In small doses it excites the vaso-motor centre. In large doses it paralyses that centre. 8. It slows the pulse by an immediate action upon the excito-motor ganglia of the heart. 9. It does not act on the pneumogastrics, but decreases the number of respiratory movements, at first from too little blood, and afterwards from too much blood flowing to the respiratory centres. 10. Artificial respiration always moderates the spasms, not by a reflex stimulation of the pneumogastrics, but by maintaining the oxygenation of the blood until the poison is eliminated.

It may, then, reasonably be believed—1, that strychnine does not act upon the muscles, the nervous extremities, or the nerve-trunks; 2, that it does act upon the nerve-centres in the medulla oblongata and medulla spinalis; and, 3, that it acts upon those centres first by stimulating them when given in small doses, and by exhausting them, and thereby exaggerating their reflex irritability, when poisonous doses are used, in this respect falling under the general law that the actions of small and of large doses of an active agent are antagonistic to one another. (Compare Poole, *Med. Record*, xix. 201.) The latter of the two effects is probably dependent, in part at least, upon the power of strychnine to contract the arteries and the heart and to slow the pulse. It is essentially through spasm, in so far as it throws the respiratory muscles into tonic

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contraction and by rendering the chest immovable, that it tends to produce asphyxia, with its usual symptoms of dark venous congestion of the eyes and interior of the mouth. This explanation renders clear the agency of artificial respiration in saving the life of animals in strychnine-poisoning (Richet, *Med. News, etc.*, Nov. 1880, p. 659), and the effect of keeping the frog's skin moist in preventing or delaying the fatal action of the poison upon this animal. In both cases the blood continues to be oxygenated until the poisonous excess of strychnine has been eliminated." (*National Dispensatory.*)

Strychnine is generally supposed to have no action upon the brain, but E. Biernaki (*Ther. Mntsh.* Aug. 1890) from experiments made upon rabbits under the influence of chloro form found that the excitability of the cortical portion of the brain showed a diminution in from 8 to 10 minutes after the administration of strychnine, this diminution of excitability reached its maximum in from 27 to 30 minutes, then remained stationary for a time (according to the dose given) after which the brain gradually recovered its normal excitability. This depressing action may be due to the hyperexcitation of the medulla oblongata and medulla spinalis, which takes place, *pari passu*, with the diminution of sensibility in the cortical portion of the brain, as excitation of one portion of the central nervous system is known to produce a depressing action upon another portion.

The inhibitory action of strychnine upon the functions of the cortical portion of the brain explains the favorable effects obtained by its administration in alcoholism, insomnia and other diseases in which there is hyperexcitability of the brain.

As regards the treatment of strychnine poisoning, the stomach should be evacuated and a brisk purgative administered. The native remedies, oil and milk, may be given to retard the absorption of the drug. If the convulsions have begun chloral hydrate or chloroform may be administered, and when asphyxia threatens artificial respiration should be resorted to. In modern medicine nux-vomica is prescribed with

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advantage in the catarrhal dyspepsia, accompanied by flatulence and want of contractile power in the intestines, which is so common in India. In such cases it appears to be preferable to the alkaloid strychnine. As a general tonic in relaxed conditions of the muscular system, and in delirium tremens, strychnine is an invaluable remedy. It is also used with advantage as a stimulant of the nervous centres in some forms of paralysis after the symptoms of irritation have subsided, and in sexual debility. Applied externally nux-vomica acts as an irritant, and if the skin is abraded its active principles may be absorbed and give rise to symptoms of poisoning.

Prof. C. Pavesi (*Bolletina Farmaceutica*, 1881,) has demonstrated the antiseptic properties of the different species of Strychnos and their alkaloids, and suggests that the effectiveness of the species of Strychnos which are used in tropical countries against fevers and poisonous bites may possibly be owing to the antiseptic and anti-fermentative power of the alkaloids.

Lauder Brunton (*Practitioner*, Jan. 1888,) recommends strychnine in sleeplessness due to mental fatigue, caused by strain or worry, as preferable to opium, chloral and bromides. He has given $\frac{1}{200}$ to $\frac{1}{100}$ grain of the alkaloid, or 5 to 10 minims of tincture of nux vomica at bedtime, the dose being repeated if the patient wake within one or two hours.

G. A. Gibson (*Practitioner*, Dec. 1889,) strongly recommends the hypodermic injection of strychnine in cases of opium narcosis, or in any case of narcotic poisoning where there occurs any irregularity or interruption of the breathing that appears to threaten a failure of the respiratory centre.

Description.—The fruit is an indehiscent berry of the size and shape of a small orange, and of a rich orange-yellow colour; it is filled with a bitter gelatinous, white pulp, in which the seeds, from 1 to 5 in number, are placed vertically in an irregular manner. The seed is disc-like, or rather irregularly orbicular, a little less than an inch in diameter, by about a quarter of an inch in thickness, slighty concave on the dorsal, convex on the ventral surface, or nearly flat on either side, often furnished

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with a broad, thickened margin, so that the central portion of the seed appears depressed. The outside edge is rounded or tapers into a keel-like ridge. Bombay nux-vomica usually has a bevelled margin, and Madras an obtuse one. Each seed has on its edge a small protuberance, from which is a faintly projecting line (raphe) passing to a central scar which is the hilum or umbilicus; a slight depression marks the opposite side of the seed. The seeds are of a light greyish hue, occasionally greenish, and have a satiny or glistening aspect, by reason of their being thickly covered with adpressed, radiating hairs. Nux-vomica is extremely compact and horny, and has a very bitter taste. (*Pharmacographia.*) The wood occurs in the shops in pieces of variable length, and from ¾ to 1 inch or more in diameter; it is covered by a thin light brown bark, which on one side of the stem is rougher than on the other, and is marked by numerous small light-coloured elliptic corky warts. A transverse section shows numerous very fine medullary rays; touched with nitric acid the section is stained a dull orange red.

Microscopic structure.—The hairs of nux-vomica are of remarkable structure. They are formed as usual of the elongated cells of the epidermis, and have their walls thickened by secondary deposits, which are interrupted by longitudinally extended pores; they are a striking object in polarized light. The albumen is made up of large cells, loaded with albuminoid matters and oily drops, but devoid of starch. If very thin slices of nux-vomica are kept for some time in glycerine, they develop feathery crystals, doubtless consisting of the alkaloids. (*Pharmacographia.*) The corky layer of the bark is composed of cubical cells of a reddish brown colour; within this is a wide zone of thin-walled cells arranged in radial and at the same time concentric rows; then come several rows of light-coloured stone cells; and lastly, a tolerably wide layer of thin-walled cells in which a few stone cells are scattered.

Chemical composition.—The bitter taste and highly poisonous action of nux-vomica are chiefly due to the presence of strych-

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nine and brucine. Strychnine, $C^{21}H^{22}N^2O^2$, was first met with in 1818 by Pelletier and Caventou in St. Ignatius Beans, and immediately afterwards in nux-vomica. It crystallises from an alcoholic solution in large anhydrous prisms of the orthorhombic system. It requires for solution about 6,700 parts of cold or 2,500 of boiling water; the solution is of decidedly alkaline reaction, and an intensely bitter taste, which may be distinctly perceived, though it contains no more than $\frac{1}{600000}$ of the alkaloid. The best solvents for strychnine are spirits of wine or chloroform; it is but very sparingly soluble in absolute alcohol, benzol, amylic alcohol or ether. The alcoholic solution deviates the ray of polarized light to the left. The discovery of Brucine was made in 1819 by the same chemists, in nux-vomica bark, then supposed to be derived from *Brucea ferruginea*. Its presence in nux-vomica and St. Ignatius Bean was pointed out by them in 1824. Brucine, dried over sulphuric acid, has the formula $C^{23}H^{26}N^2O^4$, but it crystallises from its alcoholic solution with $4H^2O$. It readily neutralises acids, forming crystalline salts. In bitterness and poisonous properties, as well as in rotatory power, it closely resembles strychnine, differing, however, in the following particulars:—it is soluble in about 150 parts of boiling water, melts without alteration a little above 130° C. In common with its salts, it acquires a dark red colour when moistened with concentrated nitric acid.

In nux-vomica as well as in St. Ignatius' beans the alkaloids, according to their discoverers, are combined with strychnic or igasuric acid; Ludwig (1873), who prepared this body from the latter drug, describes it as a yellowish brown amorphous mass, having a strongly acid reaction and a sour astringent taste; and striking a dark green with ferric salts.

Nux-vomica dried at 100° C. yields when burnt with soda lime 1·822 per cent. of nitrogen, indicating about 11·3 per cent. of protein substances. The seeds contain 4·14 per cent. of fat. Meyer found it to yield butyric, capronic, caprylic, caprinic and other acids of the series of the common fatty acids, and also one acid richer in carbon than stearic acid.

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Nux-vomica also contains mucilage and sugar. The latter, which according to Rebbling (1855), exists to the extent of 6 per cent., reduces cupric oxide without the aid of heat. When macerated in water, the seeds easily undergo lactic fermentation, not however attended with decomposition of the alkaloids. The stability of strychnine is remarkable, even after ten years of contact with putrescent animal substances. (*Pharmacographia.*)

W. R. Dunstan and F. W. Short discovered (1884) a new glucoside in the pulp of the fruit of *Strychnos Nux-vomica* to the extent of 4 to 5 per cent., and named it *Loganin.* This substance answers to the formula $C^{25}H^{34}O^{14}$. They have also shown that loganin is present in small quantity in the seeds and in preparations made from them. (*Pharm. Journ.* [3] XIV., 1025.)

In nine samples of nux-vomica seeds examined by Beckurts, the percentage of total alkaloids ranged from 1·53 to 3·42 per cent. The same chemist found the percentage of strychnine in ten determinations to vary between 2·17 and 2·38 per cent. (*Archiv. der Pharm.*, 1890, 330-347.) W. R. Dunstan and F. W. Short in a sample of seeds from Ceylon found as much as 5·34 per cent. of total alkaloids. They found the pulp of the fruit to contain 1·4 per cent. of strychnine and 1 per cent. of brucine. (*Pharm. Journ.* [3], XIV and XV.)

The wood and bark of *S. Nux-vomica* (Bidara Laut) have been examined by H. G. Greenish, who found 2·26 per cent. anhydrous brucine in the dry wood, and as much as 7·38 per cent. in the dry bark. No trace of strychnine could be detected. The bark of *S. Nux-vomica* has been found to contain varying amounts of brucine according to age: old bark, 1·68 per cent.; medium, 2·4 per cent.; and young bark, 3·1 per cent. (*Pharm. Journ* [3] IX., 1013.)

D. Hooper (*Pharm. Journ.* 1890) found the leaves of *S. Nux-vomica* to contain ⅕ of a per cent. of alkaloid consisting of brucine, but no strychnine could be detected.

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Toxicology.—Nux-vomica is seldom used as a poison in India, probably on account of the difficulty experienced in powdering it. In Bengal, from 1880 to 1887, out of a total number of 1,766 cases of poisoning investigated by the Chemical Analyser to Government, only 3 were from nux-vomica. In the N.-W. Provinces and Oudh, during the same period, one case was observed in a total of 1,529 viscera examined. In the Punjab no case was recorded in a total of 1,871 viscera examined during the same period. In Madras, during the seven years from 1882 to 1888, three cases of poisoning with nux-vomica were recorded, all three occurred in 1886, and in all the nux-vomica had been mixed with orpiment. In Bombay Dr Lyon remarks that poisoning by nux-vomica is occasionally met with, the cases being generally suicidal or accidental; in the ten years ending 1884 he records one case of cattle poisoning by this drug. Among the causes leading to accidental poisoning may be mentioned the practise of nux-vomica eating, which many authorities state to be commonly practised in certain parts of India on account of its stimulant and aphrodisiac properties. (See *Chevers' Med. Juris.* p. 241.) Nux-vomica has been found by the Chemical Examiner at Madras to be sometimes added to arrack to increase its intoxicating effect. Accidental cases of poisoning with nux-vomica bark have also been recorded owing to its substitution for Holarrhena bark by ignorant druggists. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of Holarrhena bark being seized, about one-fourth of it was found to consist of nux-vomica bark.

Since the introduction of Strychnine into India as a medicine by Europeans, it has been not unfrequently used as a poison.

In Bengal the Chemical Examiner reported its detection in human viscera three times in 1880-81, once in 1881-82, once in 1882-83, twice in the remaining nine months of 1883, three times in 1885, and twice in 1886. In 1884 and 1887 no cases occurred, making a total of 12 cases of strychnine poisoning in 1,766 viscera examined.

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In the Punjab, during the period between 1879 and 1887, only two cases were recorded—one in 1879 and one in 1887.

The total number of viscera examined was 1871.

In the N.-W. Provinces and Oudh no case is recorded during the same period.

In the Madras Chemical Examiner's reports we find under the head of "Human Viscera Examined, Class A," that in 1882 strychnine was detected in 2 out of 152 cases; in 1883, in 4 out of 123 cases; in 1884, in 8 out of 85 cases; in 1885, in 4 out of 81 cases; in 1886, none; and in 1887, in 2 out of 76 cases; in 1889, in 3 out of 101. Under the head of "Suspected Attempts to Poison" strychnine was detected in the articles examined twice in 1882, once in 1883, and once in 1887. In 1884 one case of cattle poisoning by strychnine is recorded.

The Reports of the Chemical Examiner, Bombay, for the ten years ending 1884 show that out of 947 cases in which poison was detected, strychnine was found 17 times.

Cattle poisoning from eating the leaves of *S. Nux-vomica* has been observed in the Madras Presidency and Mysore.

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The following table, compiled by Assistant Surgeon C. L. Bose, Assistant Chemical Examiner to the Government of Bengal, shows the particulars of poisoning by Nux-vomica and Strychnia in India:—

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liqr. Strychnia.		
Bengal...............	1873	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1874	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1877	2	...	...	...	......	...	...	...	...	...	...	......	....
Do.	1878	4	...	1	...	......	...	...	...	...	...	...	......	"Of the four deaths from poisoning by strychnia, three were accidental and arose from strychnia having been in two instances mistaken for santouin. In one, a mother finding some medicines among her deceased husband's effects, set aside some powder which she took to be santonin, and subsequently administered a portion of this to two of her children. Both the children died, and the powder proved to be strychnia. In the other instance, the strychnia was sold from a dispensary in mistake for santonin. Both these accidents occurred in Calcutta. *Dur-*

														ing the previous year (1877-78) *a similar case came to this office from Sibsagar*. A labourer in a tea-garden at Golaghat asked a fellow coolie for some santonin for himself and his son. Both the man and the boy died some hours after taking the dose given. Strychnia was detected in the stomach of both."
Do.	1879	5	...	...	...	....	...	...	...	...	...	...	......	"There were 5 deaths from poisoning by strychnia, against 4 in the previous year. Of these 5 cases only one was due to strychnia having been mistaken for santonin, against 3 deaths arising from a similar mistake in 1878-79."
Do.	1880	1	2	...	...	......	1	1	...	5	2	...	......	"A somewhat rare form of poisoning by the bark of the strychnos nux-vomica occurred in Calcutta, in which a young child was given a strong decoction of nux-vomica bark, *kuchila*, instead of a similar preparation of the bark of the *Holarrhena antidysenterica, kurchi*. From the evidence which transpired, it appeared that the child had been suffering from dysentery, and a native practitioner, who had some repute in the treatment of that disease, ordered his specific, the prescription being directed to be taken to his own dispensary for compounding. The compounder

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.		
Bengal.—(*contd.*)	1880													in charge, an unqualified man, finding no *kurchi* bark in store, purchased some from a bunniah. *Kuchila* bark was supplied instead, and not being recognized, the prescription was duly dispensed. An 8-oz. mixture was sent, the dose being one tablespoonful and the child of 2 years of age; the decoction was, I believe, of such a strength that one ounce represented the extractive matter from an ounce of the bark. Half a dose was administered, and was followed by death in 15 minutes. Brucia was detected in the mixture, and also in the stomach and vomit." "*Kuchila* and *kurchi* bark have certain points of resemblance: bunniahs sell both, and after the poisoning case above referred to, the police obtained samples of *kurchi* bark from various

Do.	1881	1	...	...	...	......	..	...	...	...	...	...	......	sources. In one instance the same bunniah sold nux-vomica bark for *kurchi* successively to two purchasers. It is impossible to surmise to what extent the substitution of *kuchila* for *kurchi* bark has occurred, but it is perfectly evident that bunniahs do not recognize the importance of distinguishing between the two drugs."
Do.	1882	1	...	...	1	......	..	...	1	5	...	1	......	.... "A fatal accident occurred in Calcutta by which a child was poisoned by the bark of nux-vomica, *kuchila* being substituted for *kurchi*. It appears that the child had been ordered decoction of *kurchi* bark, which is a bitter tonic and astringent. The drug was purchased from a bunniah, the medicine prepared, and its administration was followed by death." "The Civil Surgeon of Sibsagar forwarded a few pills and wrote as follows:—'The pills were made by a Dr. D. P. Dass of Calcutta, and are stated to cure dysmenorrhœa, amenorrhœa, leucorrhœa, menorrhagia, and uterine diseases. A female patient took one of the pills, and about an hour afterwards was seized with violent spasms and became comatose.' The pills were found to contain strychnia and brucia."

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Presidency.	Year.	Human viscera: Strychnia.	Human viscera: Brucia.	Human viscera: Strychnia and Brucia.	Human viscera: Nux-vomica. (bark or seed.)	Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases: Strychnia.	Brucia.	Strychnia and Brucia	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.	Suspected substances in connection with cattle poisoning cases.	Remarks.
Bengal—(*contd.*)...	1883	1	...	1	...	......	...	...	...	2	...	...	......	
Do.	1884	...	...	...	2	......	...	...	...	12	...	...	......	"The seeds of ***strychnos nux-vomica*** were detected in the stomachs of two individuals, and the bark or seeds of this tree amongst 12 of the substances suspected to be poison or to contain poison." "One of the two cases in which nux-vomica bark was detected in the stomach occurred at Pooree, where a native herbalist appears to have substituted nux-vomica bark for sahajmari bark. It was reported that Kapil Das, a Hindoo male, aged 35, ground together some bark of sahajmari, molasses, and ganja with water, and afterwards drank the mixture on the night of the 25th instant, and was found dead next morning with blood oozing from his mouth. Nux-vomica was detected in the stomach. The other case occurred at

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Shahabad. Debalakin Jalahin, a female, aged 30 years, was reported by the police to have died by eating opium. The relatives of the deceased stated that the death was due to cholera. The chemical examination detected nux-vomica."

"From Dinagepore, a case of alleged criminal poisoning by nux-vomica was reported. Nillo Nishya, a Hindu male, stated that, after taking his food, he felt a hot sensation in his mouth extending to his throat and stomach, and that this was immediately followed by vomiting. He suspected his wife of poisoning him, and had the house of his wife's paramour searched, and found there two flat beans and other herbs which were sent for chemical examination along with the vomited matter. The two beans were the seeds of *strychnos nux-vomica*. No poison was found in the other herbs or in the vomited matter. In a case of suspected poisoning at Purneah, a few packets of suspected substances were sent for examination, and nux vomica 'seeds' were detected in one of them."

"In a case at Tipperah, a Mohamedan male, named Jahan Buksh, died

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica.	Liq. Strychnia.		
Bengal.—(contd.)	1884													suddenly after taking some medicine which was administered to him for the relief of a colic pain. A few pieces of the bark, of which he was said to have eaten, were sent for examination, and identified, physically and chemically, as nux-vomica bark." "There seems to be little doubt but that a considerable number of deaths are annually caused in Bengal through the carelessness of herbalists and others in subtituting nux-vomica bark for the bark of a non-poisonous medicinal tree. "Considerable insight was obtained in the month of May last as to how this substitution may occur. Kurchi bark is in great repute amongst natives as a mild antiperiodic and tonic for children, and a decoction of kurchi bark is also used in many native hos-

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pitals. The apothecary of the Campbell' Hospital when proceeding to make some decoction for hospital use, observed, amongst the kurchi bark, a piece of bark which he felt convinced was nux-vomica bark, and he reported the matter to Dr. Coull Mackenzie, the Superintendent of the Hospital. A second quantity of kurchi bark was sent for to the same native druggist who supplied the first lot, and this too contained several piece of nux-vomica bark. The police were then informed of the matter by Dr. Mackenzie. They proceeded to the shop of the druggist and seized the whole of his remaining stock of so-called kurchi bark, and forwarded the three lots of bark for chemical examination. Nux vomica bark was found in all three lots in very large amount, making up about one-fourth of the entire quantity of the bark."

"One of the most remarkable features in the mortality returns of Calcutta is the enormously high death-rate from tetanus. During 1884, 1,204 deaths were registered under the heading of tetanus, and the mortality for 1884 in this respect was not unusually high. The large bulk of the

Presidency.	Year.	Human viscera. Strychnia.	Human viscera. Brucia.	Human viscera. Strychnia and Brucia.	Human viscera. Nux-vomica (seed or bark.)	Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases. Strychnia.	Brucia	Strychnia and Brucia	Nux-vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.	Suspected substances in connection with cattle poisoning cases.	Remarks.
Bengal—(contd.)...	1884													cases which figure in the returns under this heading occur in children and infants; and such enormously high prevalence of tetanus has never been satisfactorily explained. As the symptoms of strychnia poisoning very closely simulate those of tetanus, it is worth considering whether or not many of the cases of alleged tetanus may not really be cases of strychnia poisoning, when it is remembered that the deadly nux-vomica bark has been proved on several occasions to have been substituted for, or mixed with, the relatively harmless *kurchi* bark, and that this latter bark is extensively used by the people for infantile ailments."
Do.	1885	3	...	...	...	......	4	...	...	5	...	...	3	
Do.	1886	1	1	...	...	......	2	..	...	2	...	...	......	
Do.	1887	..	..	...	...	......	1	...	...	5	...	...	1	The five substances in connection with cattle poisoning were found to be nux-vomica.
Do.	1888	1	...	...	1	......	1	...	...	1	...	...	......	
Do.	1889	1	...	...	...	......	3	...	...	3	...	...	1	

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Bombay	1871	1	...	...	...	......	...	...	...	...	...	...	......	"In the case of poisoning by strychnia, the alkaloid was detected in the contents of the stomach and in the liver of a female. Marked symptoms of poisoning by strychnia were present during life. The exact quantity taken was not known. It was, however, ascertained that 10 grains by weight of strychnia was in the deceased's house shortly before she was attacked with symptoms of poisoning. After her death no portion of this quantity could be found. Only three other case of poisoning by strychnia (all non-fatal) have come before me during the past five years. Dr. Chever's remark that 'commonly as the nux-vomica finds a place among the Bazaar drugs of Bengal, it would appear that it is by no means frequently employed in this country as a means of destroying life' is thus fully supported by the experience of the Bombay Chemical Analyser's office."
Do.	1872	...	...	...	...	1	...	...	...	...	...	...	......	"The single case in which strychnia was detected was in some respects a curious one. A medical practitioner, resident in Bombay, sitting down to tiffin, cut off and gave to a favourite dog a piece of the meat before him. He was called away before he had time to eat any himself, and on his return

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux vomica (seed or bark)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liqr. Strychnia.		
Bombay—(*contd.*)	1872													about half an hour afterwards, found his dog dying. He naturally suspected that the meat he had given to the dog was poisoned and called in the police. On examination strychnia was detected in the contents of the stomach of the dog, but none could be found in the meat. The probable explanation of the case was that the dog had got hold of the poison from the police, who were at the time poisoning stray dogs in Bombay with strychnia."
Do.	1874	...	...	...	...	......	...	...	...	...	...	...	......	"The case in which strychnia was found was that of a man at Satara caught in the act of attempting to commit suicide by taking a white powder which on examination, proved to be strychnia. This he probably stole from the police, who use it for destroying dogs."

Do	1876	...	...	...	...	......	2	...	...	...	...	......	"Two cases in which strychnia was detected came under notice during the year. One of these, except from the rarity of the poison, was not of particular medico-legal interest. The second case was as follows:—Two patients in a hospital were ordered mixtures containing the Liq Hydrarg. Perchloridi of the British Pharmacopœia. The quantities ordered were respectively 45 minims every 3rd hour for patient A, and one fluid drachm every 3rd hour for patient B. Patient A who was under treatment for some of the symptoms of Locomotor Ataxy, having taken two doses of his mixture was found suffering from intense headache and spasms of the extremities brought on by the least draught of air; and subsequently furious delirium set in. Patient B took only one dose of his medicine and was attacked with tetanic symptoms. Further administration of the mixtures was stopped, and what was left of them was sent to me for examination. I found both mixtures to correspond to the prescriptions, except that mercury was absent from them, and strychnia present; and it subsequently became clear that in making up the prescriptions the Liq. Strychnia of the British Pharmacopœia had by mistake been

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux vomica (bark or seed.)	Ext. Nux-vomica	Liq. Strychnia.		
														substituted for the Liq. Hydrarg. Perchloridi which had been ordered.
Bombay—(*contd.*)	1878	2	...	...	...	......	2	...	...	...	...	...	......	"This poison was detected in 4 cases (two of them fatal cases) during the year. Of the two fatal cases, one was sent up from Kaira, and was the case in which a man was stated to have committed suicide by swallowing a packet of poison used for killing dogs. On analysis, the poison was detected in the contents of the stomach and in the liver of the deceased: the other fatal case came from Bassim in the Berars. In this case, a boy, aged 11, is reported to have eaten some sugar given to him by a compounder employed in a charitable dispensary." The boy almost immediately complained of a bitter taste, and some pain about the right ear, and soon afterwards laid down, became violently convulsed, and died in about 15 minutes On

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examination, I detected strychnia in the contents of the stomach of the deceased. Of the non-fatal cases, one from Godra was a case where a constable, it is alleged, gave a man, also a police constable, two powders, stating that they were fever medicines. One of these powders the sufferer swallowed at about 3 P. M After taking the powder a bitter taste and feeling of nausea was noticed, very soon after "followed by convulsive movements of the arms and legs, and generally of all the voluntary muscles." The convulsive movements were accompanied by intervals of relaxation of the muscles. During the spasms the body was bent backwards. "There was giddiness and confusion of thoughts, which afterwards merged into insensibility." The symptoms disappeared at about 12 P. M. The remaining powder on examination I found to be strychnia. The history of the other non-fatal case is thus detailed by the hospital assistant, Paranti dispensary :—"Complainant's wife gave bread to her daugher to eat; who complained of its bitter taste, upon which her mother tasted it, then her father (the complainant), as well as four or five men sitting at the time in the complainant's house, each and

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux vomica	Liq. Strychnia.		
														all complained of its bitter taste. They, therefore, got another bread prepared out of the remaining flour from which the first bread was prepared and gave it to a dog. The dog ate the whole, and after about a quarter of an hour, it fell down trembling, became convulsed, and soon after died." The bread was sent for examination, and on analysis strychnia was detected in it. During the seven years previous to the year under report, only 5 cases altogether of poisoning, or alleged poisoning in which strychnia was the poison employed, came before this office. This year I have had to notice 4 cases, and it will be observed that in two of these, and perhaps in all, the employment of strychnia as a poison is traceable to its introduction into use for the purpose of destroying dogs.

Bombay—(*contd.*)	1879	2	..	...	...	......	1	...	...	1	...	...	......	"In a case from Haveri, a packet containing seeds which on examination proved to be nux-vomica seeds, was forwarded with a request that I would state whether such seeds if administered to a pregnant female would be likely to cause abortion. Two fatal cases of poisoning by strychnia, one from Poona and the otherfom Dharamgaon (Khandesh District), were referred during the year. In the Poona case a boy, aged 5, died in about three quarters of an hour after eating some sweetmeat given to him and to his two brothers by, it was alleged, a police Havildar. Deceased's two brothers, finding the sweetmeat had a bitter taste, did not eat it. Strychnia was found on analysis in the contents of the stomach of the boy who died. The Dharamgaon case appears to have been an accidental one, arising out of some strychnia powders supplied to the police for the purpose of destroying dogs, having been mistaken for cinchona alkaloid powders supplied as a febrifuge."
Do.	1880	1	...	...	...	......	1	...	...	...	...	...	......	"Two cases came under notice during the past year in which strychnia was detected; one of these from Dharwar, was a case where this alkaloid was detected in the contents of the

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
														stomach of a hospital assistant, who, it was reported, had committed suicide while under the influence of liquor, by swallowing a quantity of strychnia. The symptoms in this case being somewhat peculiar, I transcribe from the report of the case the following account of them:—"Deceased, half an hour after taking the poison, was found lying on his cot on his stomach, and remained throughout in that position, returning to it every time an attempt was made to alter it. He could not answer questions. Respiration very hurried, rapid and stertorous. Jaws so firmly fixed that the stomach pump could not be used nor emetics efficiently administered; pulse quick and full at first; tongue much bitten and bleeding; eyelids firmly closed; *no convulsions*, merely slight muscular twitchings of face and arms. The second case was forwarded from

														Ratnagiri, and was one in which strychnia was detected in some vegetable powder found in a cup near the dead body of a man, who, it was suspected had committed suicide."
Do.	1883	...	...	...	...	......	1	...	...	1	..	...	......	"A case was submitted by the Bombay Police in which some quack pills were found to contain a minute quantity of strychnia."
														"A case from Haveri, in which a nux vomica seed was found in the contents of a packet suspected to contain poison."
Do.	1885	2	...	...	...	......	...	...	...	...	...	...	......	"Strychnia was detected in 2 cases, viz.—(1) In the contents of the stomach and liver of a young female who, it was reported, had committed suicide by swallowing powdered nux vomica seeds This case was sent up from Sasvad (Poona District); (2) in a case which occurred in Bombay, where five prisoners, four of whom died, were accidentally poisoned by strychnia given to them by mistake for cinchona alkaloid."
Do.	1887	...	...	...	...	......	2	...	...	...	...	...	......	"The poison was detected in two cases during the year, from respectively, Dindori (Nasik District) and Ahmednagar. In the first the alkaloid was

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Bombay—(*contd.*)	1887													detected in the vomit of a young man who attempted to commit suicide. The sufferer was the son of a police constable, and the strychnia swallowed by him was a portion of some issued to his father for the purpose of destroying dogs. In the Ahmednagar case, strychnia was detected in some fragments of bread and also in some powders sent for examination therewith. Two boys, aged respectively 9 and 4, sons of a police constable, abstracted some strychnine powders from their father's bag. Of these they used two in poisoning dogs. Subsequently they appear to have mixed a third with the bread sent for examination, and were about giving this bread to some boys when they were stopped by the Police schoolmaster. The powders sent along with the bread were found hidden under some rubbish in the school-room."

Do.	1889	...	...	...	...	......	..	...	...	2	...	...	......	(1) "A case from Nagar (Ahmednagar, district) in which some seeds and powders were recognized as nux-vomica seeds and chalk mixed with red lead. They were found on the person of some accused, but no further history was forwarded. (2) A case from Patan (Satara district) in which nux-vomica seeds and powder of arsenious oxide and sulphate of copper were forwarded for identification, no notes of the case being afforded."
N.-W. P. & Oudh.	1870	...	...	...	...	......	...	...	...	...	...	...	......	Strychnia—1. It is not mentioned whether the detection was in connection with human or animal poisoning cases.
Do. ...	1875	1	...	...	...	......	1	...	...	...	...	...	......	"Referred by the Superintendent of Tarai. This was a case of suicide, the person being Tarachand Bhaduri, an Assistant Surgeon at Kashipoor in the Tarai. After death two phials were found in his pockets, one empty and labelled "Prussic acid," the other labelled "Strychnia" and containing some of those substances. I made a careful search in the stomach and its contents for prussic acid but found none. I then tested for strychnia, and detected it by the usual process. From the history of

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica.	Liq. Strychnia.		
														the case it would appear that this unfortunate man must have taken a large dose, as the symptoms of the poison were not only well marked, but he died in about 5 minutes after the first symptoms were observed."
N.-W. P. & Oudh. (*contd.*)	1878	...	...	...	...	......	...	...	...	...	...	...	......	Strychnia—2. Detected in connection with human poisoning cases, but whether in the viscera or in the suspected substances it is not mentioned.
Do. ...	1879	...	...	...	...	......	...	...	...	...	...	...	......	Nux Vomica—1. Detected in connection with human poisoning cases, but whether found in the stomach or among the suspected substances it is not mentioned.
Do. ...	1881	...	...	...	...	......	1	...	...	1	...	...	......	"From Ballia. The substance examined was found to be nux-vomica. This is also a drug often to be found in bazaars and yet not much used as a poison."

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														"An officer of the Royal Artillery stationed in Meerut suspected that the tea made for him by his servants had been drugged with some poison used for killing mice, &c. I found the vermin killer contained a small quantity of strychnia, but I could not find a trace of this alkaloid in the tea."
Do.	1885	...	...	...	1	1	..		...	...	...	...	......	"From Azimgarh. This was a case of suicide in which it was supposed that the subject of it, a woman of name unknown, had taken powdered nux-vomica; but finding that death came too slowly she drowned herself. Small fragments of nux-vomica were found among the contents of the stomach, and strychnia, the active principle of nux-vomica, was also found in the substance of the stomach."
														"Cattle case from Sitapore concerning poisoning a horse—poison used was nux-vomica."
Madras	1879	1	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1880	...	...	...	...	......	...	...	...	2	...	...	......	"A woman was believed to have committed suicide with nux-vomica leaves. No fragments of the leaves or traces of strychnia were contained in the stomach. Some leaves which were sent up were found to be leaves of nux-vomica."

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Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica. (bark or seed)		Strychnia.	Brucia.	Strychnia and Brucia	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Madras—(*contd.*)	1881	2	...	...	...	......	...	...	...	...	...	...	......	....
Do.	1882	2	...	...	...	......	2	...	...	...	...	...	......	"Strychnia was detected in viscera in two instances. One case may have been a case of suicide. In the other case a man who was suffering from leprosy seems to have been poisoned either accidentally or intentionally by his medical adviser. The medicine which was being used was found to contain a very large amount of strychnia and brucia with an immense quantity of pepper and ginger." "Nux-vomica seeds in powder were also found in a powder which a man was accused of having forcibly rubbed into the mouth of a woman before attempting to commit a rape upon her. The poison was also found twice in native medicines, the properties of which were required to be known."
Do.	1883	7	...	...	...	......	3	...	...	...	...	...	......	In seven instances strychnia was detected in the human viscera, and in three instances among substances suspected to be or to contain poison.

Do.	1884	8	...	...	...	......	...	...	...	...	...	...	1	"Strychnia was detected in three cases. One from Godavari was said to be a case of suicidal poisoning by opium; no opium was found. In the second case from Nellore, a woman was reported to have vomited, been purged, and died within three hours. The third case from Salem is remarkable, because the victim was said to have died twenty-four days before the *post-mortem* examination of the body was held, and nearly two months before the chemical examination of the viscera took place. The history of the case indicated the probability of death having been produced by some irritant poison administered by an enemy of long-standing, who was supposed to have recently been reconciled to the deceased." No mention is found of the remaining five cases. Nux-vomica was detected in connection with the cattle-poisoning case.
Do.	1885	4	...	...	...	......	...	...	...	...	...	...	......	....
Do.	1886	...	...	...	3	......	...	...	...	...	...	...	......	The nux-vomica was mixed with orpiment in all of the three cases.
Do.	1887	2	...	...	...	......	1	...	...	...	...	...	......	In one case strychnia was discovered in large quantity where opium had also been used. The strychnia was detected not only in the viscera, but also in the urine which was drawn off *post-mortem*. The case was remark-

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.		
														able from a medico-legal point of view, because the action of the strychnia was much delayed and modified by the opium taken along with it. The patient was taken ill at 10 A. M., and the symptoms then were occasional spasmodic contractions of the muscles of the upper extremities. Later on the temperature rose, but the spasms ceased. At 4 P. M. the patient vomited. At 7-15 P. M. he had a fit of convulsions and died. Zinc sulphate and apomorphia had been administered without effect.
Madras—(*contd.*)..	1889	1	...	...	...	......	...	...	...	...	...	...	......	"The corpse of a woman (widow) was dragged out of a well, and as the cause of death could not be ascertained at the inquest, the body was conveyed to the local dispensary by the police. On getting ready for the *post-mortem* examination, a dead fœtus dropped out of the winding sheet, *post-*

mortem delivery having occurred on the way unnoticed by the bearers of the corpse. There were no signs indicating that any attempt to cause abortion had been made; there were no signs of drowning; the fœtus was seven or eight months old; and its delivery was accompanied by a total inversion of the uterus. Strychnia was found in the viscera sent. The occurrence of child-birth after the life of the mother had become extinct, without the aid of art, and indeed even after interment, has been recorded and vouched by many observers of established credit, the independent contractile power of the uterus, or cadaveric rigidity being stated to be the chief factors in the production of this accident. So-called "cadaveric spasm" also known to occur at or after death by strychnine poisoning, and to persist till true cadaveric rigidity comes on, disappearing only with it. In the present instance the body must have lain for about 18 hours in the water, cadaveric rigidity had all but passed away at the time of examination (only the upper limbs being slightly stiff) and no doubt expulsion of the fœtus occurred by the pressure of the gaseous products of putrefaction which filled the abdo-

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Presidency.	Year.	Human viscera. Strychnia.	Human viscera. Brucia.	Human viscera. Strychnia and Brucia.	Human viscera. Nux-vomica (bark or seed.)	Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases. Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. strychnia.	Suspected substances in connection with cattle poisoning cases.	Remarks.
														men. The possibility of this accident occurring is a point in obstetric jurisprudence, which should not be forgotten when examining the dead body of a female alleged to have miscarried.
Punjab..	1873	...	...	...	...	......	...	...	...	1	...	...	1	Nux-vomica was detected in connection with the cattle-poisoning case.
Do.	1879	...	...	...	...	......	...	...	...	1	...	...	1	"Nux-vomica is very rarely used for murder, as strychnia has one of the most bitter tastes known, suspicion would be at once aroused. During the last two years, only one case has been referred, that of a man poisoned by his wife by mistake, who gave him the drug by the advice of a fakeer as an aphrodisiac."
Do.	1880	2	...	...	...	......	1	...	...	...	...	...	......	"In one of the strychnia cases, a police officer took a quinine powder, as he supposed, from a drawer in which such were kept for distribution. From this drawer there were sent 93 powders of strychnine, each of 5 grains,

														along with a large number of powders of cinchona febrifuge and sulphate of quinine. It was not stated whether they had been made up to poison beasts."
Do.	1881	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1882	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1883	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1884	...	...	...	...	......	1	...	...	2	...	...	......	....
Do.	1886	...	...	...	...	......	...	...	...	1	...	...	1	Used for procuring abortion. Nux-vomica was detected in connection with the cattle poisoning case.
Do.	1887	...	...	...	...	......	...	...	..	1	...	...	......	....
Do.	1888	...	...	...	...	......	...	...	...	3	...	...	......	....

The following cases of poisoning by nux-vomica and its alkaloids are recorded in Dr. Brown's Book on "Punjab Poisons":—

No. 108. "In a case which was brought to the Medical College, Calcutta, in 1880, an old man put five of the seeds into a vessel of water and allowed it to stand all night long; the next morning he drank off the water. About half an hour afterwards he began to feel giddy and unable to stand, and at length he had a fit. About three hours after he was brought to the hospital, not having vomited, and the stomach pump was used; as soon as the tube of this passed the throat a spasmodic attack was occasioned, in which all his limbs became stiff and remained so for about 3 minutes; after this ceased, the tube was conveyed into the stomach, which was throughly cleaned out, and a dose of opium was administered. There was no return of the fit, and the next day he was quite well. The above forms a good example of a very mild case of this form of poisoning."

"Case No. 48 of 1862, Umballa.—A man ate some sugar; soon after he complained of twitchings and spasms in the throat and limbs; he vomited and afterwards recovered; strychnia was detected in the sugar used."

"Case No. 134 of 1869.—Several persons partook of food in which nux-vomica seeds had been put; within a minute they complained of a bitter taste in the mouth, twitchings of the throat, and giddiness and vomiting occurred; they subsequently suffered from cramps and twitching in the limbs, dimness of sight and weakness, but fell asleep two hours afterwards and then recovered. Nux-vomica seeds and strychnia were found in the vomited matter."

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Collection.—Cochin nux-vomica is collected in the dry deciduous forests at the foot of the Travancore hills, and is sold to small native dealers at a low rate, who send it to the merchants. The Coconada nux-vomica is obtained from the Ganjam district and Godavery. The Madras seeds come from Nellore and several other parts of the Presidency. The dirty and discoloured seeds, such as those left by monkeys, hornbills and parrots only fetch half rates. The best seed is obtained by collecting the fruits, washing out the seeds and drying in the sun. The right of collection is sold by the Forest department over fixed areas, and in the upper taluks of the Godavery in 1889, 5,500 maunds were taken out on payment of seigniorage. The last Nellore sales fetched Rs. 12 per candy of 20 maunds, that is, Rs. 2-8-0 per cwt. in Madras. In the Concan the seed is collected in a similar manner by the Mhars and other outcastes, and is sold to the small dealers at an average rate of one anna per measure of about 4lbs.

Commerce.—Large quantities of nux-vomica are exported from India. The annual exports from Bombay amount to about 4,000 cwts., all shipped to the United Kingdom. Madras and Cochin export still larger quantities, and Calcutta rather less. An extensive business is done in this drug at Cocanada, from which port it is shipped to Calcutta, Madras, Alleppy, Cochin, Bombay and Europe. The bags are made up to contain 164—165 lbs. each, and are valued at Rs. 3 per bag.

Exports from Cochin.	Cwt.
1883-84	2,396
1885-86	10,787
1886-87	2,535
1887-83	7,575
1888-89	3,255
1889-90	17,716

STRYCHNOS IGNATII, *Berg.*

Fig.—*Rev. de Plant. Vasc. Filip. App., p.* 449. Saint. Ignatius' Bean (*Eng.*), Féve de Saint Ignace (*Fr.*).

Hab.—Philippine Islands. The seeds.

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Vernacular.—Papita, from Spanish Pepita (*Ind. Bazars*).

History, Uses, &c.—The seeds were first described in Europe by Ray and Petiver (*Phil. Trans.*, 1699, xxi., 44, 87), from information furnished to them by the Jesuit missionary Camelli, and probably were brought to India by Jesuit missionaries about the same date. They are described in the *Makhzan-el-adwiya* of Mir Muhammad Husain (A.D. 1769) as the seeds of a fruit, about the size of an orange, brought from the New World; of a hot and dry nature, an excellent remedy in cholera and obstinate vomiting, and useful in all cold phlegmatic diseases, such as asthma, dropsy, rheumatism, &c. The dose is one to two grains, with two or three peppercorns rubbed down in water. There is a lengthy account of the seeds in the *Talif-i-sharifi*, which the author informs us is chiefly compiled from European works. Loureiro says:—"I have often given and seen others give a whole seed weighing one drachm rubbed in water or wine to buffaloes, horses, cows and swine as an anthelmintic." The plant, hitherto imperfectly known to European botanists, has now been fully described and figured by Don Sebastian Vidal y Soler, Chief of the *Commission de la Flora Forestal de Filipinas*, in their "*Revision de plantas vasculares Filipinas,*" published at Manilla in 1886.

The seeds are not now used medicinally in Europe, but when cheap are readily purchased for the manufacture of strychnia. They are officinal in the United States.

Description.—St. Ignatius' Beans are about an inch in length, their form is ovoid, but by mutual pressure it is rendered very irregular, and they are 3 to 4 or 5-sided, bluntly angular or flattish, with a conspicuous hilum at one end. In the fresh state they are covered with silvery adpressed hairs; portions of a shaggy brown epidermis are here and there perceptible on those found in commerce; but in the majority the seed shows the dull grey granular surface of the albumen itself. Notwithstanding the different outward appearance, the structure of St. Ignatius' Beans accords with that of Nux-vomica. The radicle however is longer, thicker, and frequently somewhat

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bent, and the cotyledons are more pointed. The horny brownish albumen is translucent, very hard, and difficult to split. The whole seed swells considerably by prolonged digestion in warm water, and has then a heavy, earthy smell. The beans are intensely bitter, and highly poisonous.

Microscopic structure.—The hairs of the epidermis are of an analogous structure, but more simple than in nux-vomica. The albumen and cotyledons agree in structural features with those of the same parts in nux-vomica.

Chemical composition.—Pelletier and Caventou (1819) found the seeds to contain the same constituents, though in different proportions, as nux-vomica; they stated the yield of strychnine (still containing brucine) to be 1·4 per. cent. Geissler (1837) likewise found 1·5 per cent. of this alkaloid. F. F. Mayer (1863), on assaying ignatia with his solution, obtained from 2 troy ounces of the seeds 4·5 grains of strychnine and 13·73 grains of brucine, which correspond to 0·52 per cent. of the former and 1·43 per cent. of the latter. The dried seeds yield 1·78 per cent. of nitrogen, indicating about 10 per cent. of albuminoids. (*Pharmacographia.*)

Commerce.—The seeds sometimes reach India from the East *via* Singapore, or are imported from Europe. Value, extremely variable.

STRYCHNOS COLUBRINA, *Linn.*

Fig.—*Rheede Hort. Mal. vii., t.* 5.

Hab.—W. Deccan Peninsula, from the Concan to Cochin. The wood.

STRYCHNOS RHEEDII, *Clarke.*

Fig.—*Rheede Hort. Mal. viii., t.* 24. Serpent's wood (*Eng.*), Bois de couleuvre (*Fr.*).

Hab.—Malabar. The wood and leaves.

Vernacular.—Nága-musádi (*Tel.*), Modira-caniram (*Mal.*), Kuchila-lata (*Hind., Beng.*), Goagari-lakri (*Guz.*), Deva-kadu (*Mar.*).

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History, Uses, &c.—The vernacular names we have given are applied to several scandent species of Strychnos, the wood of which is used medicinally in India, and is known in Europe as *lignum colubrinum*. In addition to the two plants placed at the head of this article, it appears to be probable that *S. Beddomei*, Clarke, *S. laurina*, Wall., and *S. cinnamomifolia*, Thwaites, yield some of the serpent's wood used by the natives, and it is well known that the wood of *S. Nux-vomica* is often sold under this name. Rheede (viii., p. 47), speaking of this wood, tells us that it is called *Pao de solor* or *Pao da cobra* by the Portuguese; and that the Malayalim word *modira* signifies mystax (μυσταξ), probably an allusion to the moustache-like tentacles of the plant. In addition to the well-known use of the wood, he says: "Folia cum zinzibere et lacte ad consistentiam unguenti cocta, arthritidem, *Vilvada* Malabaribus appelata abigit; balneum ex illis præparatum idem præstat." Vilvada is a term applied to neuralgic pains. The *arbor ligni colubrini* of Rumphius (1, 70) appears to have been *S. colubrina*; he states that it is used in Java as a febrifuge and anthelmintic, and also externally in certain skin diseases. This species is described by Rheede under the name of *Scheru-Katu-Valli-Caniram*. He says that the Dutch call it *Wild Klimmend Kraanoog*; that the bruised fruit is applied to the head in mania, that the root rubbed down with pepper is given to check diarrhœa, and that boiled with oil it is used as a liniment for pains in the joints. The bark and wood of the different species of Strychnos appears to be the Katukavalli of the Rájá Nirghanta, often confounded with Kutaja, the bark of *Holarrhena antidysenterica*. In the vernaculars the Sanskrit Katu, bitter, becomes Kadu, Karu, Kadva, Karva, Karo, Kaura, &c., and Kuta, a water pot, becomes Karva, Karua, Karaya, &c. These names are very loosely applied to many bitter medicines, and often lead to dangerous mistakes. Ainslie wrongly supposes *lignum colubrinum* to be the *Dand-el-sini* of Ibn Sina. The latter writer, speaking of Dand, says:—

الصيني مذر كالفستق والسنجري مثل الخروع الاحمر منقط
بوعر والهندي اصغر من الصيني واكبر من السنجري

i.e. Chinese Dand is like a pistachio nut, and the kind called Sanjari is like a red castor seed, marked with rough patches. The Indian Dand is smaller than the Chinese, but larger than the Sanjari. *Dand* is a Persian name for Croton and Castor seeds of different kinds, and is the equivalent of the *Hab-el-Khatai* (Cathay berries) and *Hab-el-Salátin* (Prince's berries) of the Arabs, who do not appear to have made use of *lignum colubrinum*. It is evidently a corruption of the Sanskrit *Danti*, and the Indian kind, smaller than the Chinese, is doubtless the seed of *Baliospermum axillare*, the Danti-vija of the Hindus.

Virey (*Histoire naturelle des Medicaments*, p. 191,) states that Bois de Couleuvre in an overdose occasions tremors and vomiting, but mentions at the same time that in smaller doses it may be considered as a useful vermifuge, and be given also with advantage in obstinate quartan agues. Guibourt considers that *S. Colubrina* yields the true lignum colubrinum, or Pao da Cobra of the Portuguese, but he is unable to decide whether the wood usually found in commerce is produced by this tree or by *S. Nux-vomica*. (*Hist. Nat.*, Ed. 1869, Vol. II., p. 557.) Its claims as an antiperiodic have been examined by Dr. Berdenis van Berkelow (*Schmidt's jahrbucher*, May 24, 1866, *Brit. and. For. Med. Chir. Rev.*, April, 1867, p. 527); after a trial with it in twenty-two cases quartan and tertian, he reports favourably of its action, and considers that from its cheapness it may advantageously be used as a febrifuge. In Bombay shops two kinds of lignum colubrinum (Goagari-lakri) are met with; the genuine and least common imported from Malabar, and the stems of *S. Nux-vomica* collected in the Concan; both are much used by the Hindus on account of their tonic properties in dyspepsia and malarious affections. In the dyspepsia of vegetarians, preparations containing strychnia are particularly efficacious, and the extract of nux-vomica in half grain doses, appears to have all the virtues of the lignum colubrinum. In the Concan the fresh leaves of *S. colubrina* rubbed into a paste with the kernel of the cashewnut are applied to suppurating tumors.

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Description.—The general structure of the bark resembles that of *S. Nux-vomica*, but it it of a rusty colour, and the small lenticels upon it, instead of being pale, are of a bright rusty brown. The pieces of wood vary much in size, and are more knotty and crooked than those of *S. Nux-vomica;* they are often as thick as a man's arm. The texture of the wood is closer, harder, and of a deeper colour; when touched with nitric acid it turns of a reddish orange. Under the microscope the zone of stone-cells in the bark is seen to be wider and more irregular than in *S. Nux-vomica*, and the cells themselves are bright yellow, and larger.

Chemical composition.—The wood was found by Pelletier and Caventou to contain strychine and brucine. H. G. Greenish (*Pharm. Journ.* [3] ix., 1013) confirmed the presence of both alkaloids in the bark and wood, the strychnine reaction being especially well marked in the alkaloid from the bark. His analysis gave 0·96 per cent. of alkaloids in the dry wood, and 5·54 per cent. in the dry bark.

STRYCHNOS POTATORUM, *Linn. f*

Fig.—*Roxb. Cor. Pl. i., t.* 5; *Wight Ill. ii., t.* 156; *Gärtn. Fruct. i., t.* 179. Clearing nut (*Eng.*).

Hab.—Deccan Peninsula, Prome, Ceylon. The seeds.

Vernacular.—Nirmali (*Hind., Beng., Guz.*), Nivali, Katak, Chilbij (*Mar.*), Chillbij (*Can.*), Tetrán-kottai (*Tam.*), Chilla-ginjalu (*Tel.*), Tetran-parala (*Mal.*).

History, Uses, &c.—This seed, in Sanskrit Kataka or Ambuprasáda (ambu, water; prasáda, clearness), has been in use in India from the earliest ages for the purpose of clearing muddy water. Kálidása says:—"the ignorant man is refined by the society of the learned as water is by the *Kataka.*" Menu (vii. 67) alluding to the popular saying that to name the *Kataka* is sufficient to purify water, remarks: "Though to name the fruit of the *Kataka* purifies water, yet the water becomes not pure, *i.e.*, faith without works avails not."

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Kataka is mentioned by Susruta in his chapter on water. One of the seeds is usually rubbed hard for a short time round the inside of the earthen pot, and the water is afterwards poured into it and left to settle; the impurities subside and the water remains clear and tasteless. Medicinally *nirmali* rubbed down with honey and camphor is applied to the eyes to strengthen the sight and prevent lachrymation; it is also used in ulceration of the cornea and purulent discharge from the conjunctiva. (*Chakradatta.*) Mahometan writers state that it is cold and dry, that when applied externally to the abdomen it relieves colic; they also notice its use to strengthen the sight and as a remedy in snake-bite. The author of the Talíf-i-sharífí recommends it in irritation of the urinary organs and gonorrhœa. He directs four of the seeds to be powdered and mixed with a little curd of milk, to be tied up in a piece of cloth and steeped in water during the night. The infusion is to be taken in the morning. Ainslie says:—"The fruit, though when very young it is made into a preserve and eaten, is reckoned in its mature state amongst the emetics of the Tamool doctors in Southern India, given in powder in the quantity of about half a teaspoonful." The *clearing nut* has a place in the secondary list of the *Pharmacopœia of India*, and is there said to be used as a remedy in diabetes, on the authority of Kirkpatrick. A suggestion is also made that the nut would be of use if supplied to troops marching in the rainy reason, when little but muddy water can be procured.

Dr. Pereira. (*Pharm. Journ.*, 1850, Vol. IX., p. 478,) suggests that the property of clearing water possessed by these seeds depends upon the albumin and casein which they contain. If the seeds be sliced and digested in water they yield a thick mucilaginous liquid, which, when boiled, yields a coagulum (albumin), and by subsequent addition of acetic acid, it furnishes a further coagulum (casein).—(*Phar. of India, p.* 146.)

Description.—The seed is nearly orbicular, button-shaped, about ½ an inch in diameter and ¼ inch thick; round the border is a slightly prominent ridge, which marks the junction

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of the two portions of albumen constituting the bulk of the seed; at one point a slight irregularity of the ridge marks the situation of the radicle, from this runs a faintly projecting line to the umbilicus, which is central and well marked, a hardly perceptible depression marks the opposite side of the seed. The integuments are yellowish grey and covered with fine silky hairs. The albumen horny but not quite so hard as that of Nux-vomica. The embryo consists of a club-shaped radicle and two delicate heart-shaped cotyledons.

Chemical composition.—We found the seeds as difficult to powder as those of Nux-vomica, and they had to be treated in a similar manner before they could be pulverised. The powdered seeds were boiled with strong alcohol acidulated with sulphuric acid, caustic potash in slight excess added, and then acetic acid to acid reaction. The solution was then evaporated to dryness on the water bath. Benzole extracted traces of an oily principle when agitated with the acid extract. After separation of the benzole the still acid solution was agitated with ether, which extracted resinous matter which became of a deep yellow colour on the addition of alkalies. The aqueous solution was then rendered alkaline with carbonate of soda and agitated first with ether and subsequently with chloroform.

In both cases intensely bitter extracts were obtained, the ether extract exceeding that yielded by chloroform. These extracts were purified,* and afforded all the reactions for alkaloids, the special colour reactions in both instances indicating the presence of brucia, and it is interesting to note that the larger amount was found in the ether extract. Portions of these extracts were injected into frogs, but beyond inducing muscular irritability no tetanizing effects were induced. Acetates of the alkaloids were employed for the hypodermic injections. We failed in obtaining any reactions for the presence of strychnia in either of the extracts. We are not however prepared to state that other alkaloidal principles are not associated with brucia in the seeds. We noted that on the

* We noted that the ether extract when first dissolved in dilute sulphuric acid, was of a yellow colour, but changed to grass green on standing.

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evaporation of the alcoholic tincture of the seeds acidulated with sulphuric acid, a beautiful violet coloration was developed on the sides of the capsule; we also obtained a similar reaction with Nux-vomica seeds. Phosphoric acid, however, failed to afford this coloration, and it was not afforded either by hydrochloric or acetic acids

GENTIANACEÆ.

GENTIANA DAHURICA. *Fisch.*

Fig.—*Act. Soc. Nat. Scr. Mos. iii.*, 63. Syn.—*G. Olivieri*, Griseb.

Hab.—Persia. The flowering tops.

Vernacular.—Gul-i-gháfis (*Indian bazars*).

History, Uses, &c.—Ibn Sina and the Eastern Arabs and Persians adopted a Persian plant called Gháfat as representing the Eupatorion of the Greeks. This plant is still sold in India under the name of Ghâfith or Ghafis. (*cf.* Vol. I., p. 582). It is described in the Burhán-i-katia as a plant one span in height, having a long blue flower and a very bitter taste. The entire plant is not unfrequently to be found in parcels of the drug which arrive from Persia. Aitchison (*Bot. of the Afghan Del. Com.*, p. 88,) speaking of *G. Olivieri*, says :—

"In great uxuriance on the sandy downs of the Bádghis, forming part of the sward along with several Carices. This is undoubtedly, as Boissier remarks, the Gentian of the hot country. It is in such profusion, that when in flower it gives a blue colouring to the downs." We are informed that it is called *Gul-kalli* by the Persian peasants from its being used to cure کلی (kalli) or ringworm of the scalp in children. Indian and Persian Mahometan physicians describe Gháfis as having leaves like hemp, and long blue flowers, &c.; they copy the description of the Agrimony plant from the Greeks, and ascribe

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to it the flowers of the Persian Gentian with which they are familiar. The medicinal properties attributed to it are those of Agrimony.

Description.—The drug, which is imported from Persia, consists of delicate quadrangular flower stalks, two to four inches in length, terminating when perfect in five flowers; one of these is terminal, the remaining four are in opposite pairs and on longish peduncles, with bracts as long as the peduncles. The corolla is funnel-shaped, about 1 inch in length, erect, five-partite; calyx five-partite; stamens five, alternate with the corolline segments; style single; stigmas two; fruit three-fourths of an inch long, one-celled, containing numerous small seeds; calyx and corolla persistent. The lower portion of the plant is sometimes to be found; it has the leaves of a gentian.

The entire plant is from 6 to 8 inches high, and very bitter.

Chemical composition.—The drug reduced to fine powder and treated with ether yielded 7 per cent. of extract, consisting almost entirely of a light yellow-coloured wax. The spirit extract contained a crystalline bitter principle, neutral in reaction, unaffected by alkaloidal reagents but precipitated by tannin. The residue, after treatment with ether and alcohol, swelled up on the addition of water, and a quantity of mucilage and red-colouring matter entered into solution.

Commerce.—The drug is an article of regular import from Persia, and sells at from 2 to 3 annas a pound.

Jintiyana.—Under this name Gentian root imported from Europe is sold in India, and is generally accepted by the hakíms as representing the Gentiana of Pliny and Dioscorides.* Mahometan writers describe Jintiyana as having purplish flowers, and give Pákhánbed as the Hindi synonym. The root sold as Pákhánbed in the bazars is that of *Saxifraga ligulata*, an entirely different plant. (*See* Vol i., p. 585.)

* Dios. iii., 3; Pliny 25, 7.

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GENTIANA KURROO, *Royle.*

Fig.—*Royle Illus., t.* 68, *f.* 2; *Bot. Mag., t.* 6470.

Hab.—Cashmere and N.-W. Himalaya. The root-stock.

Vernacular.—Karú, Nilkant, Kamal-phúl (*Hind.*).

History, Uses, &c.—This drug is not mentioned by Sanskrit writers on Materia Medica. Their Katuki, in the vernaculars Katki and Karú, which is in general use all over India, is undoubtedly the root of *Picrorhiza Kurrooa.* In the *Dictionary of the Economic Products of India* (iii., p. 486,) it is stated that *G. Kurroo* is largely exported to the plains along with *P. Kurrooa* as the officinal Karu or Katki, but we have been unable to find anything like the root of a Gentian in the original parcels of that drug which arrive from the hills. We believe that all the references to this plant, as a drug in use in the plains, belong properly to Picrorhiza, and that *G. Kurroo* is only used in the Himalayas and northern districts of the Punjab.

Description.—The root-stock is perennial and creeping, terminating in knotty crowns from which spring numerous vertical rhizomes from 3 to 6 inches in length; the latter, which form the bulk of the drug, are bluntly quadrangular, about as thick as a goose-quill, and marked on each face by the remains of a closely set single vertical row of rootlets; they are also transversely wrinkled, and terminate in a scaly tuft consisting of the remains of leaves and flower stems. A transverse section shows that the rhizome consists of a central quadrangular woody portion, surrounded by a thick cortex, both of a light yellow colour, tough, and having the odour and taste of Gentian root.

Chemical composition.—The roots contain a bitter principle similar to that of the European species; it is soluble in water and alcohol, and is not thrown down by neutral acetate of lead, but is precipitated by ammoniacal acetate; and liberated from the precipitate by sulphuretted hydrogen. It can be extracted

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from an aqueous solution by agitation with benzine or ether, but more readily by chloroform. Ferric chloride does not precipitate it, nor does tannin. Sulphuric acid colours it reddish, and the dilute acid decomposes it with the production of sugar. The root also contains a yellow, transparent, brittle resin, resembling mastic, in softening at the temperature of the mouth ; it is odourless and tasteless, neutral in reaction, and insoluble in alkaline liquors. The presence of this resin to the extent of nearly 20 per cent. of the dried root should at once distinguish this Gentian from other species.

SWERTIA CHIRATA, *Ham.*

Fig.—*Wall. Pl. As. Rar.* iii., *t.* 252; *Bentl. and Trim.*, *t.* 183. Chiretta (*Eng.*), Chiretti (*Fr.*).

Hab.—Temperate Himalaya. The plant.

Vernacular.— Kiráyat (*Hind.*, *Guz.*), Chireta (*Beng.*), Kirait (*Mar.*), Nila-vembu (*Tam.*), Nela-vemu (*Tel.*), Nelabevu (*Can.*), Nila-veppa (*Mal.*),

History, Uses, &c.—Kiráyat has long been an important article of the Hindu Materia Medica. It is mentioned by Susruta and other Sanskrit writers under the name of Kiráta-tikta, which means the bitter plant of the Kirátas, an outcaste race of mountaineers in the north of India. It is also called Anárya-tikta, "the bitter plant of the non-Aryans." Another Sanskrit name is Bhunímba, "ground-nim." The herb is much esteemed by the Hindu physicians on account of its tonic, anthelmintic and febrifuge properties, and is prescribed in masked forms of malarial fever in which the chief symptoms are dyspepsia; it is usually combined with aromatics, such as ginger and lemon grass.

It is also considered to be laxative, anthelmintic and alterative. In the Bhaishajya-ratnavali, a decoction is directed to be made of equal parts of chiretta, Tinosposa stems, raisins, emblic myrobalans and zedoary root. Chiretta is one of the 54 ingredients of the compound powder known as Sudarsana-

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churna, and it gives its name to a compound oil called Kirátádi-taila, in which it is combined with 26 other drugs, mostly aromatics and stimulants. This oil is rubbed on the body in obstinate cases of ague, causing emaciation and anæmia. (*Bhaishajya-ratnavali.*)

Mahometan writers upon Indian drugs have identified Chiretta with the Kasab-ed-darira of the Arabs, and Calamus aromaticus of Dioscorides. Guibourt was also of the same opinion, but Fée and Royle dissent from it.

The author of the *Makhzan-el Adwiya* gives at the end of his article upon Kasab-ed-darira the following short summary of the manner in which Chiretta is used by the Hindu physicians:—

"They consider it to be cold and dry, light and flatulent; a remedy for colds and bilious affections, burning of the body, and the fever arising from derangement of the three humors which they call *sannipàt* (fever with delirium)." The plant was first described by Roxburgh under the name of *Gentiana Chirayita* in 1814. Ainslie notices it, and remarks that it appears to be much used in Bengal; it was probably rather a scarce drug in Southern India in his time, as he says little about it. In England it began to attract attention about the year 1829; and in 1839 was introduced into the Edinburgh Pharmacopœia. It is now official in the British and Indian Pharmacopœias, and is generally accepted as a valuable bitter tonic. In Western India it has a reputation as a remedy for bronchial asthma, and in some cases we have known it used with success.

Description.—The entire plant is collected when in flower, or more commonly when the capsules are fully formed, and tied up with a slip of bamboo into flattish bundles about 3 feet long, each weighing when dry from 1½ to 2 lbs. The stem, $\frac{2}{10}$ to $\frac{3}{10}$ of an inch in thickness, is of an orange-brown, sometimes of a dark-purplish colour; the tapering simple root, often much exceeding the stem in thickness, is 2 to 4 inches long and up to ½ an inch thick. It is less frequently branched, but always provided with some rootlets. In stronger speci-

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mens, the root is somewhat oblique or geniculate; perhaps the stem is in this case the product of a second year's growth, and the plant not strictly annual. Each plant usually consists of a single stem, yet occasionally two or more spring from a single root. The stem rises to a height of 2 to 3 feet, and is cylindrical in its lower and middle portion, but bluntly quadrangular in its upper, the four edges being each marked with a prominent decurrent line, as in *Erythræa Centaurium* and many other plants of the order. The decussate ramification resembles that of the other Gentians; its stems are jointed at intervals of 1 to 3 or 4 inches bearing opposite semi-amplexicaul leaves or their cicatrices. The stem consists in its lower portion of a large woody column, coated with a very thin rind, and enclosing a comparatively large pith. The upper parts of the stem and branches contain a broad ring of thick-walled woody parenchyme. The numerous slender axillary and opposite branches are elongated, and thus constitute a dense umbellate panicle. They are smooth and glabrous, of greenish or brownish grey colour.

The leaves are ovate, acuminate, cordate at the base, entire, sessile, the largest one inch or more in length, 3 to 5 or 7-nerved, the midrib being strongest. At each division of the panicle there are two small bracts. The yellow corolla is rotate, 4-lobed, with glandular pits above the base; the calyx is one-third the length of the petals, which are about half an inch long. The one-celled bivalved capsule contains numerous seeds.

The flowers share the intense bitterness of the whole drug. The wood of the stronger stems is devoid of the bitter principles.

Chemical composition.—At the request of the authors of the *Pharmacographia*, a chemical examination of chiretta was made by Höhn under the direction of Professor Ludwig of Jena. The chief results may be thus described. Among the bitter principles of the drug, *Ophelic Acid*, $C^{15}H^{20}O^{10}$, occurs in the largest proportion. It is an amorphous, viscid, yellow sub-

stance of an acidulous, persistently bitter taste, and a faint gentian-like odour. With basic acetate of lead, it produces an abundant yellow precipitate. Ophelic acid does not form an insoluble compound with tannin; it dissolves in water, alcohol and ether. The first solution causes the separation of protoxide of copper from an alkaline tartrate of that metal.

A second bitter principle, *Chiratin*, $C^{26}H^{48}O^{15}$, may be removed by means of tannic acid, with which it forms an insoluble compound. Chiratin is a neutral, not distinctly crystalline, light yellow hygroscopic powder, soluble in alcohol, ether and in warm water. By boiling hydrochloric acid, it is decomposed into *Chiratogenin*, $C^{13}H^{24}O^{3}$, and Ophelic acid. Chiratogenin is a brownish, amorphous substance, soluble in alcohol but not in water, nor yielding a tannic compound. No sugar is formed in this decomposition.

These results exhibit no analogy to those obtained in the analysis of the European gentians. Finally Höhn remarked in chiretta a crystallisable, tasteless yellow substance, but its quantity was so minute that no investigation of it could be made. The leaves of chiretta, dried at 100° C., afforded 7·5 per cent. of ash; the stem 3·7, salts of potassium and calcium prevailing in both. (*Op. cit. 2nd. Ed., p.* 437.)

Commerce.—Most of the chiretta of commerce is said to be collected in the Morung district of Nepal; it is packed in large bales, which contain about 1 cwt., and arrives in India about the end of March, when a stock may be laid in at about 2 annas per lb. An inferior kind, known as *Mitha kirayat*, "sweet chiretta," is frequently met with; it is sometimes packed separately, and sometimes mixed with the true drug, but can be easily recognised by the almost complete absence of the central pith, and by its deficient bitterness. This spurious chiretta has been noticed in the London market and described by Prof. Bentley. (*Pharm. Journ.* [3] v., 481.) It is said to be derived from *S. angustifolia*, Ham.

Elborne in 1883 noticed the occurrence of Munjit (Madder) stems in some bundles of Chiretta.

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Swertia decussata—*Nimmo, Wight Ill., t.* 157, *bis f.* 3 *f.*, Syn.—*Ophelia multiflora*, a native of the West Deccan Peninsula, is used under the name of Silájit as a substitute for chiretta. The whole plant is bitter, but the root is preferred, and is said by Dr. Broughton and others who have used it to be an excellent substitute for gentian. It is not an article of commerce, but is sold in the bazar at Mahableshwar under the name of Kadú, which simply means "bitter." The *S. corymbosa* on the Nilgiris, and the *S. pulchella* on the Pulneys, are used as tonics in place of the true chiretta.

Description.—Stem quadrangular, 4-winged, ascending densely leafy; leaves round ovate; stem clasping, 5-nerved, mucronulate, glabrous, decussate; cymes many-flowered; calyx divisions lanceolate, acuminate; corolla white, 4-divided, segments ovate, elliptic, their rounded pits surrounded by long fringes; filaments united at the very base; capsules large, cylindrical, erect; seeds minute. Root of the diameter of a quill, giving off two or three rootlets, covered with a whitish-brown epidermis, when dry wrinkled longitudinally, white internally, and brittle.

ENICOSTEMA LITTORALE, *Blume.*

Fig.—*Bot. Mag. ii., t.* 28; *Wight Ic. t.* 600.

Hab.— Throughout India, except in Bengal. The plant.

Vernacular.—Chhota-kiráyat (*Hind.*), Mámijva (*Guz.*), Nella-galli (*Tel.*), Vellurugu (*Tam.*).

History, Uses, &c.—This plant does not appear to have been noticed by Sanskrit writers on Materia Medica, but it is popularly known in many parts of India, along with several other bitter herbs as a kind of *Kiráyat*. It is most abundant in moist situations near the coast, and is also found in Tropical Africa and the West Indies. Roxburgh describes it under the name of *Gentiana verticillata*, but says nothing about its medicinal properties. In the *Pharmacopœia of India* it is noticed under the name of *Cicendia hyssopifolia*.

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According to Cleghorn it is much used by the natives of Madras as a stomachic, as in addition to its tonic properties, it is also somewhat laxative. (*Ind. Ann. of Med. Sci.* iii., *p.* 272.)

Description.—Root perennial, creeping, filiform. Stems herbaceous, simple, erect, from 6 to 12 inches high, four-sided, jointed; leaves opposite, sessile, lanceolate, 3-nerved, smooth, entire, 1½ to 2 inches long, by half an inch broad; flowers axillary, sessile, generally threefold, small, white; corolla funnel-shaped. The whole plant is bitter.

Chemical composition.—The aërial and subterranean portions of this plant were examined separately; the former gave 34 per cent. of dry alcoholic extract and 15·7 per cent. of ash, and the latter 15·5 per cent. of dry alcoholic extract and 10·4 per cent. of ash. The bitter principle from both portions appeared to be identical and to have the characters of a glucoside. It was left as a varnish-like residue from the evaporation of its solution in chloroform, and was also soluble in ether, benzol, alcohol and water. It gave a reddish-brown colour with strong sulphuric acid, which changed to a purplish tint after standing. The hydrolysis of the bitter principle with dilute hydrochloric acid resulted in the production of an agreeable aromatic substance, and the deposition of a flocculent light-brown colouring matter.

CANSCORA DECUSSATA, *Roem. et Sch.*

Fig.— *Bot. Mag. t.* 3066.

Hab.— Throughout India. The plant.

Vernacular.—Sankháhuli, Dánipola, Dánakuni (*Hind.*), Dánkuni (*Beng.*), Sankhvel (*Mar.*), Cansjan-cora (*Mal.*).

History, Uses, &c.—This plant is mentioned in Sanskrit medical works, under the names of Shanka-pushpi, Kambu-pushpi, Kambu-malini and Dandotpala, as a laxative, alterative, and nervine tonic. Chakradatta recommends the fresh juice of the plant to be given in doses of about an ounce in all sorts of insanity; he also prescribes it as a nervine tonic.

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It seems probable that the Sanskrit names are applied in different parts of the country to more than one species of Canscora. Rheede (*Hort. Mal.* x., *t.* 52), figures *C. perfoliata* with the Malayalim name of the *Cansjan-cora*, from which the botanical name of the genus has been derived. The different species of Canscora are bitterish annual plants which grow in moist situations during, or immediately after the rainy season. They have pink, yellow or white flowers, and are of no medicinal importance.

Description.—Stem about a foot high, perfectly erect (Danda-utpala), four-sided, angles very sharp, or rather membrane-winged, smooth, ramous, branches always opposite cross-armed, in other respects like the stem; leaves opposite, spreading, sessile, lanceolate, sharp-pointed, entire, smooth, 3-nerved, size various; flowers terminal and axillary, peduncled, the terminal ones three-fold, the axillary single, white; peduncles 4-sided; calyx large, 4-toothed, 4-sided, 4-winged; corol funnel-shaped, border irregular, 3-parted, the two upper segments equal and orbicular, the lower one 2-parted, with a deep groove, in the groove is lodged the fourth or large stamen; filaments four, inserted into the mouth of the tube, the lowermost longer than the other three; style single; stigma 2-cleft, segments recurved; capsule one-celled, many-seeded.

Other plants belonging to this Order which are sometimes used medicinally are the different species of **Exacum,** amongst which may be mentioned *E. tetragonum* in Northern India and *E. bicolor* in the Deccan Peninsula.

Erythrœa Roxburghii has been recommended as a substitute for Chiretta; it is a delicate little plant from 4 to 10 inches high, appearing in cultivated ground after the rains.

The root is small and fibrous, sparingly branched, the stem quadrangular and winged; lower leaves obovate-oblong, obtuse, those on the stem linear-acuminate; cymes dichotomous; flowers bright pink, starlike; capsules oblong, mucronate, ¼ of an inch long, dehiscing, 2-celled, covered by the long sepals and inflated silver-paper-like tube of the corolla.

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BORAGINEÆ.

CORDIA MYXA, *Linn.*

Fig.—*Delile Fl. Ægypt, t.* 19, *f.* 1 ; *Wight Ill., t.* 169 ; *Rheede Hort. Mal. iv. t.* 37. Small Sebesten Plum (*Eng.*).

Hab.—Throughout India. Egypt to Cochin-China. Australia. The fruit and bark.

CORDIA OBLIQUA, *Willd.*

Fig.—*Bedd. Fl. Sylv., t.* 245 ; *Wight Ic., t.* 1378. Large Sebesten Plum (*Eng.*).

Hab.—Western India. Punjab and Hindustan to Ceylon. The fruit.

Vernacular.—Lasora (*Hind.*), Bahubára (*Beng.*), Bhokar, Shèlvant (*Mar.*), Bargund, Gondani (*Guz.*), Naruvili (*Tam.*), Nakkera, Botuku (*Tel.*), Viri (*Mal.*), Doduchallu (*Can.*). The adjective *great* or *small* is added to these names to distinguish the two species.

History, Uses, &c.—The fruits of these trees are the Selu, Bahuvara, or Sleshmátaka of Sanskrit writers, the Sapistán of the Mahometans, and the Sebestens of old European works on Materia Medica. *C. Myxa* is supposed by some to be the κοκυμηλέα ἀιγύπτια of Theophrastus. The natives of India pickle the fruit of both trees. Medicinally the dried fruit is valued on account of its mucilaginous nature and demulcent properties ; it is much used in coughs and chest affections, also in irritation of the urinary passages ; in larger quantities it is given in bilious affections as a laxative. Mahometan writers describe two kinds of Sapistán ; the greater (*C. obliqua*), the pulp of which is separable from the stone, and the lesser (*C. Myxa*), the pulp of which is adherent. The word Sapistán is an abbreviation of Sag pistán, which means in Persian 'Dog's

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dugs.' In Arabic they are called Dibk and Mukhitah, in allusion to their glutinous pulp. Both trees are minutely described by Roxburgh. According to Horsfield the bark of *C. Myxa* is used by the Javanese as a tonic. This tree is the *Vidimaram* of Rheede, the *Fruita d' Entrude* of the Portuguese, and the *Arbor glutinosa* or *Kleeverige Boom* of Rumphius.

Description.—*C. obliqua* : Drupe oblate-spheroidal, about an inch or inch and a quarter in diameter, smooth, when ripe yellow ; pulp in large quantity, soft, clear and very clammy, one-celled ; nut nearly circular, laterally compressed, rugose on the outside, with a cavity at each end, the lower one deeper than the other, exceedingly hard, 4-celled, though rarely all fertile ; seed solitary, ovate-oblong.

C. Myxa: Drupe globular, smooth, the size of a cherry, sitting in the enlarged calyx, when ripe yellow ; the pulp almost transparent, very tough, and viscid ; nut cordate, at both ends bidentate and perforated, rugose, somewhat 4-sided, 4-celled, but it rarely happens that all prove fertile; seeds solitary. (*Roxburgh.*) Both kinds of fruit when dry are shrivelled, and of the colour of a dry prune. The pulp of *C. obliqua* can be separated from the nut, that of *C. Myxa* cannot; on sawing through the nut a heavy disagreeable smell is observable.

Chemical composition.—The pulp of the fruit of *C. obliqua* freed from seeds had the following composition :—

	Per cent.
Moisture	12·85
Extracted by hot water	64·25
Sugar (by copper estimation)	29·76
Acidity neutralizing Na HO	0·23
Alkalinity of ash as KHO	3·06
Total ash	8·85
Ash in insoluble residue	1·52

The alcoholic extract solution in water gave no indication of an alkaloid, and was not rendered turbid with lime water. Sebesten plums appear to have properties similar to prunes, as they exert a gentle laxative action when taken in any quantity.

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A decoction of the bark of *C. Myxa* was not affected by iodine solution, and was only slightly turned green by ferric chloride. The alcoholic extract contained some white, transparent crystals belonging to the square prismatic system. They had no peculiar taste, were neutral in reaction and unaffected by alkaloidal reagents and the stronger mineral acids. The aqueous extract was dark-coloured, free from bitterness, and a substance like cathartin was precipitated from it by six volumes of alcohol. Nothing was found in the bark to account for its reputed tonic action. Some simple crystals of calcium oxalate were present, and the reduction of this salt to carbonate, by burning, contributed largely to the 12·75 per cent. of ash.

CACCINIA GLAUCA, *Savi.*

Syn.—*C. Celsii, Boiss. Fl. Orient iv. p.* 277.

Hab.— Persia. The herb and flowers.

Vernacular.—Gaozabán (*Ind. Bazars*). The flowers, Gul-i-gaozabán (*Ind. Bazars*).

History, Uses, &c.— A plant named βουγλωσσος is mentioned by Dioscorides, Paulus Ægineta, Pliny and other Greek and Latin writers as useful in the cold stage of fevers as a stimulant when added to wine.*

Dioscorides says of it, ἔοικε δε φλόμω φυλλον χαμαιπετές τραχύ τε καὶ μελάντερον ὅμοιον βοός γλώσση "it has leaves like *Verbascum*, procumbent, but rough and blacker, like a bullock's tongue." Marcellus Vergilius, in his commentary upon Dioscorides, brings strong evidence in favour of the opinion that the Bugloss of the ancients was Borage, laying special stress upon the fact that Dioscorides, Paulus Ægineta, Galen and Pliny all mention its addition to wine to increase its stimulating effects, a well known use of the plant up to the present time.

Forskahl (*Desc. Anim.*, *p.*146; *Flora* lxii.) identifies the Lisán-el-thour of the Arabs with Borage. The author of the *Makhzan*,

* Diosc. iv, 123; P. vi.; Pliny 25, 40.

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with other Persian writers, assumes that the Gaozabán of Persia is the same as the Bugloss of the Greeks and Romans: he then unmistakably describes the leaves, flowers and fruit of the Gaozabán we now receive from Persia, and says that most of the drug comes from Gilán. He also mentions another kind with smaller leaves as coming from Azimábád in India. Mír Muhammad Mumin, in his *Tuhfat-el-Múminin*, says that in Ispahán and some other towns of Persia a kind of Gaozabán is called Marmakhúz, and has a small round blue flower. In Persia Gaozaban is used as a demulcent in colds and coughs, and the ashes are applied to cure scald head in children.

In India the drug has long held a high place in native practice as an alterative tonic in syphilitic, leprous, and rheumatic cases; it has also diuretic and demulcent properties. O'Shaughnessy (*Beng. Disp., p.* 420,) notices it favourably, but there is some doubt as to the kind of Gaozabán used by him. Mr. M. Sheriff and others have suggested its use as an alterative instead of Sarsaparilla. It may be given in decoction (1 oz. to a pint of water) in doses of from 2 to 4 ounces three or four times a day. Whatever its alterative powers may be, there can be no doubt as to its mucilaginous and saline properties. Aitchison found the Persian Gáozaban growing abundantly in the Badghis and Khorasan as well as in the Hari-rud valley. He states that the root stock is eaten by the natives, and that it is laden with a most viscid juice, which seems to be palatable to the people of those parts. (*Trans. Linn. Soc. 2nd Ser. Botany, Vol iii., Pt.* I., *p.* 83.)

Description.—The following description is drawn up from an examination of original bales of the plant and flowers imported from Persia:—Gaozabán is a large herbaceous, perennial plant with black woody rhizomes, 1 to 2 inches in diameter, and terminating in a knotty head, from which spring several angular stems, thickly studded with calcareous tubercles and armed with stiff, white, calcareous bristles. The leaves, which are very fleshy, entire, petioled, and of an ovate-acuminate shape, have a slightly waved margin; the argest seen were 8 inches long by 4½ inches broad, the cauline

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leaves were 4½ by 2 inches, gradually decreasing to 1 inch; both sides of the leaves are thickly studded with calcareous tubercles which support stiff, white, calcareous bristles. Heads of flowers scorpioid and branched, thickly studded with white stiff bristles; bracts lanceolate to linear lanceolate, bristly; calyx half an inch long, 5-partite; segments linear-lanceolate, bristly; peduncles very short when the plant is in flower, lengthening to half an inch when in seed, and becoming studded with calcareous spots; pistil hairy, bifid at the apex, double the length of the calyx; corolla one and a half inch long, half an inch wide at the throat, funnel-shaped, almost bilabiate, externally hairy, 5-lobed, two upper lobes longest, throat of corolla glabrous, naked; stamens five, attached, a few long, weak hairs between the stamens; the fruit consists of oblong rugose nuts, ¼ to $\frac{5}{16}$ of an inch long, supported upon bony cups one-twelfth of an inch in diameter. If long kept the flowers lose their deep blue colour and turn reddish.

Chemical composition.—In boraginaceous plants there occurs a nitrogenous substance differing from gluten, the solution of which in boiling water solidifies on cooling to an imperfect jelly, and is precipitated by acids. It is also precipitated by the alkaline earths and by most salts, but tannin merely clouds it. (*Braconnot, J. Phys.* 84, 274.) In Gaozabán this nitrogenous substance is particularly abundant.

The ash of the leaves and stalks of Gaozabán has been examined by Deshmukh (1884), with the following results:—Silica, 24·17; Carbonic acid, 15·71; Alumina with traces of iron, 1·87; Lime, 27·31; Magnesia, 2·77; Potash, 14·56; Soda, 9·51; Sulphuric acid, 1·79; Phosphoric acid, 1·06; Chlorine, 1·47.

Commerce.—Value, Goazabán, Rs. 7 per maund of 37½ lbs.; Gul-i-gaozabán, Rs. 12 per maund.

TRICHODESMA INDICUM, *Br.*

Fig.—*Wight Ill. t.* 172.

Hab.— Throughout India, except in the Bengal plain.

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TRICHODESMA ZEYLANICUM, *Br.*

Fig.—*Bot. Mag. t.* 4820; *Jacq. Ic. Pl. Rar. ii., t.* 314.

Hab.—Deccan Peninsula and Ceylon. The herb.

Vernacular.—Jhingi, Jhingino (*Hind., Mar.*), Kouri-buti, Ratmandu (*Punj.*), Gaozabán (*Sind.*).

History, Uses, &c.—These plants bear the Sanskrit names of Jhingi, Jhingini, Sirishika, Durbala and Ambu-sirishika; they are considered to be demulcent, alterative and alexipharmic; useful for the removal of phlegmatic humors, skin diseases, &c. The Hindi and Marathi names, which are derived from the Sanskrit, are applied in the vernacular to various rough or prickly objects; in Hindi Jhinga is a name for shrimps or prawns, and in Marathi Jhingi signifies rough hair or bristles, and also a stinging kind of fish. The authors of the *Makhzan-el-Adwiya* and *Tuhfat-el-Muminin* notice a small kind of Gaozabán with a round blue flower, which is probably a Trichodesma. *T. indicum* is mentioned in Spry's *Modern India* as being in repute as an antidote to snake poison. Dr. Walker (*Bombay Med. and Phys. Soc. Trans.*, 1840, *p.* 72,) notices the use of Indian Borage in the Deccan on account of its emollient properties. In the Punjab and Sind it is used as an alterative and diuretic like the Persian Gaozabán; in the latter province *T. Africanum* is also used under the name of *Pábarpáni.*

Description.—Bristly, with hairs springing from tubercles and also more or less villous, leaves mostly sessile-lanceolate or cordate-lanceolate, 1-4 inches long, tuberculate on the upper surface; lower pedicels often distinctly axillary, 1-flowered; clayx lobes (at least in fruit) cordate or hastate at the base, $\frac{1}{3}$—$\frac{1}{2}$ inch, more or less grey or white-villous; corolla tube $\frac{1}{3}$ inch, lobes $\frac{1}{3}$ inch, ovate, suddenly acuminate; staminal cone densely woolly on the back; nutlets $\frac{1}{6}$ inch, sometimes very rough on the inner surface, obscurely margined. In the variety *amplexicaule,* the leaves are amplexicaul and strigose beneath on the nerves, but glabrous between them. *T. Zeylanicum* has usually denser, and more softly villous racemes than *T. Indicum,* in other respects it hardly differs from it.

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Chemical composition.—Like others of the same family these plants afford a nitrogenous substance, differing from gluten, the solution of which in boiling water solidifies on cooling, and is precipitated by acids, alkaline earths, and most salts, whilst tannin merely clouds it. The ash contains silica, lime, magnesia, potash and soda, in combination with carbonic, sulphuric and phosphoric acids and chlorine.

Several other plants belonging to this order are used as substitutes for Borage, such as **Onosma echioides** and **O. bracteatum** in Northern India (*Stewart*, *Royle*), **Heliotropium ophioglossum** in Sind (*Stocks*).

ALKANET.

This colouring matter was well known to the Greeks and Romans as ἄγχουσα and Anchusa. It is mentioned by Theophrastus (vii., 9), Dioscorides (iv., 35, 36) and Pliny (22, 23). Dioscorides describes three kinds; it was used chiefly to colour medicines. Ibn Sina calls it انجرسا (anjusa); he gives Khass-el-himar "ass's lettuce" as the Arabic name, and quotes Galen's opinion of its medicinal properties; he also mentions several other names for the different kinds of alkanet. The author of the *Makhzan-el-Adwiya*, in his article upon Abu-Kalsa, gives various names for the four kinds of alkanet described by Mahometan writers; he states that Harjuya is the Persian, and Ratanjot the Indian name for them. In India the roots of *Onosma Hookeri*, Clarke, and of a species of Arnebia from Afghanistan, are known as Rang-i-badshah, "king's dye," and Ratanjot, and are chiefly used for colouring medicinal oils, &c.; a third kind of alkanet is imported from China, and consists of long, woody, twisted roots like the alkanet of Europe, which is chiefly derived from *Alkanna tinctoria*, Tausch, and is the *Orcanette* of the French. Alkanet imparts a rich red colour to spirit, ether, oils and fats, which is insoluble in water; with alkalies it gives fine blue colours. The name *alkanet* is derived from the Arabic الحنا (al-khanna), and was formerly applied to *Lawsonia alba*, Lam.

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HELIOTROPIUM INDICUM, *Linn.*

Fig.—*Wight Ill., t.* 171; *Rheede, Hort. Mal. x.,* 48. Indian Turnsole (*Eng.*).

Hab.—Throughout India. The herb.

Vernacular.—Háthi-shúra (*Hind.*), Hátisúra (*Beng.*), Bhúrúndi (*Mar.*), Tét-kodukki (*Tam.*), Télumani, Nágadanti (*Tel.*), Tél-kotukka, Teliyanni (*Mal.*), Háthi-sundhána (*Guz.*).

History, Uses, &c.—This plant is the Hasti-sunda of Sanskrit writers, it is also called Sri-hastini, from its being held in the hand of Sri or Lakshimi; it appears to be very generally used as an astringent and vulnerary in different parts of the world. It is the Bena Patsja of Rheede. Ainslie describes it under the name of *Heliotropium indicum.* Of its medicinal properties he says:—

"The juice of the leaves of this plant, which is a little bitter, the native practitioners apply to painful gum boils, and to repel pimples on the face; it is also prescribed as an external application to that species of ophthalmia in which the tarsus is inflamed or excoriated. The *Heliotropium indicum* is also a native of Cochin-China and of the West Indies; in the first mentioned country the natives call it Cay-boi-boi. Of its virtues, Loureiro says:—'Folia istius herbæ contusa maximé conducunt ad majores anthraces, vel, quando incipiunt, resolvendos, vel postea suppurandos.' (*Flor. Coch.-Chin., Vol. I., p.* 103.) It is well described by Browne, in his History of Jamaica (p. 150), and I find Barham (p. 42) tells us that it cleans and consolidates wounds and ulcers, and that boiled with castor oil it relieves the pain from the sting of a scorpion, and cures the bite of a mad dog!" (*Mat. Indica, Vol.* II., *p.* 414.)

In India also the plant is used as a local application to boils, sores, and the stings of insects and reptiles.

Description—An annual plant common in ditches where the soil is rich. The whole plant is more or less covered with simple hairs, stems several, as thick as the little finger, hollow, branched from the axils of the leaves; leaves generally alternate,

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cordate-ovate, rugose, long-petioled; petioles margined; spikes terminal, solitary, simple; flowers like those of the garden Heliotrope, but smaller; fruit mitre-shaped. The plant has a fetid odour like Stramonium; taste a little bitter.

Chemical composition.—The stems and leaves, besides containing a tannin soluble in ether, affording a dirty green coloration with ferric chloride, and an organic acid, non-crystalline, also soluble in ether, gave very marked evidence of the presence of an alkaloidal principle soluble in ether, and yielding marked precipitates with the ordinary alkaloidal reagents: with potassic chromate it afforded no precipitate, and it gave no special colour reactions. It was tasteless.

Heliotropium Eichwaldi, *Steud. Eichw. Itin. Casp-Caucas* 10, *t.* 4, differs little from *H. europeum,* Linn. Its leaves, boiled in castor oil, are said by Murray to be used in Sind to relieve the pain of scorpion stings, and also for cleansing and and healing ulcers. *H. brevifolium* and *H. undulatum* are used for similar purposes in Northern India. The ἡλιοτρόπιον το μέγα of the Greeks (*Theophr. H. P. vii.,* 8, 9, 10; *Diosc. iv.,* 195,) is supposed to have been *H. europeum,* the same plant was the Herba Solaris of the Romans, and was used by the ancients to expel bile and phlegm, and locally applied to scorpion stings. P. L. Simmonds (*Amer. Journ. of Pharm.* Feb. 1891) states that it contains a toxic alkaloid. It obtained its name from a myth which is related by Ovid (*Metamorph. Lib. iv., Fab.* 6), in which the nymph Clytie in love with the Sun was turned into this plant, but still retained her affection for her lover.

> "Membra ferunt hæsisse solo: partemque coloris.
> Luridus exsangues pallor convertit in herbas.
> Est in parte rubor, violæque simillimus ora
> Flos tegit. Illa suum, quamvis radice tenetur.
> Vertitur ad solem: mutataque servat amorem."

> "Her looks their paleness in a flower retained,
> Still the lov'd object the fond leaves pursue,
> Still move their root, the moving Sun to view,
> And in the *heliotrope* the nymph is true."

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Plants of minor importance belonging to this Order, which are used medicinally, are:—

Ehretia buxifolia, *Roxb. Cor. Pl. i., t.* 57, a shrub of the Deccan Peninsula, called *Kuruvingi* in Tamil, the root of which, according to Ainslie, is sweet and slightly pungent when fresh, and is used as an alterative in cachexia and syphilis; the Mahometans consider to be an antidote to vegetable poisons.

Ehretia obtusifolia, *Hochst.*, a native of Sind and the Punjab, is considered to have similar properties.

Coldenia procumbens, *Linn., Lam. Ill., t.* 89, a common weed in rice fields during the cold season, known to the natives as Tripakshi or Tripankhi, is, when dried and powdered, made into a paste with an equal proportion of powdered fenugreek, and applied to boils to promote maturation.

CONVOLVULACEÆ.

IPOMÆA TURPETHUM, *Br.*

Fig.—*Bot. Reg., t.* 279; *Bot. Mag., t.* 2093.

Hab.—Throughout India and Ceylon. The root. Turpeth root.

Vernacular.—Nisot, Nákpatr, Pitohri (*Hind.*), Teori (*Beng.*), Shivadai, Shivadai-vér (*Tam.*), Tegada, Tegada-véru (*Tel.*), Chiváka-véra (*Mal.*), Tigadikeputigadi (*Can.*), Nishottar, Tartari, Shetvara, Phutkari (*Mar.*), Nishotar (*Guz.*).

History, Uses, &c.—This drug, which bears the Sanskrit names of Triputa, "three-angled," Trivrit, "three-fold," Kutaruná, Tinti and Nindika, is described in the Nighantas as pungent, cathartic, dry, sweet and hot; a dispellent of wind, fever, phlegm, bile and melancholy, and bitter and digestive. Sanskrit writers mention two varieties, Sveta—"white," and Krishna or Shama, "black"; the latter kind bears the names of

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Kálá, Káláparni and Kálámeshi, and is described as a violent purgative. Its source has not been satisfactorily ascertained, but it is supposed to be the root of *Lettsomia atropurpurea*, Clarke, a native of Nipal and Sikkim. *I. Turpethum* is sacred to Siva, to whom the flowers are offered by the Hindus. It is one of the most common native cathartics, and has probably been in use all over India from a very early date. The usual method of administration is to rub down about a drachm of the root or stem with water, and add to it some rock salt and ginger, or sugar and black pepper. Under the name of *Turbud*, an Arab corruption of Triputa, Mahometan writers also mention two kinds, white and black, and direct the black to be avoided on account of its poisonous properties, which are said to resemble those of Hellebore. As regards the properties of Turbud they say that it is a drastic purgative of phlegmatic humors and bile; its action is promoted by combination with ginger; it is particularly beneficial in rheumatic and paralytic affections. Combined with chebulic myrobalans it is useful in melancholy and dropsies.

Ainslie says—"The *Convolvulus Indicus alatus maximus* had long a place in the British Materia Medica, but of late years has fallen into disuse. I find it mentioned by Avicenna under the name of Turbud; but the first among the Arabs who prescribed it was Mesue (see *Spreng., Rei Herbariæ, Vol.* 1, *p.* 249), also Rhazes (c. 173). Alston in his Materia Medica speaks of turpeth as a strong and resinous cathartic, and recommended in his days in gout, dropsy and leprosy. The plant is known to the modern Greeks by the name of τουρπεθ; it is a native of the Society and Friendly Isles, as well as of India, of the New Hebrides and of New Holland. Virey, in his *Histoire Naturelle des Medicaments* (p. 184), speaks of the root of the *Convolvulus Turpethum* as more drastic than the common jalap, which, however, it does not seem, is to be found in India." (*Mat. Ind.* II., *p.* 384.)

Wallich, Gordon, and Glass considered this drug to be of considerable value as a cathartic. Sir W. O'Shaughnessy (*Beng. Disp.*, *p.* 504), found it so uncertain in its operation that

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he pronounced it unworthy of a place in the Pharmacopœia. In this opinion he is undoubtedly correct, as the active resins are present in the root in a much smaller proportion than in jalap, but as the drug is very cheap it might be used with advantage for preparing the commercial resin. Turpeth when administered by the mouth excites irritation of the stomach with nausea, colic, and watery, mucous stools; in excessive doses it excites inflammation of the gastro-intestinal mucous membrane and bloody dejections. Like jalap it is an hepatic stimulant, increasing the secretion of biliary matter and rendering it more watery. Being a hydrogogue cathartic it is useful for the removal of dropsical effusions, and in such cases it acts best in combination with ginger and bitartrate of potash. The dose should be about double that of the ordinary jalap powder of commerce, equal to from 4 to 5 grains of the resin.

Description.—The Turpeth of commerce consists of the root and stem of the plant cut in short lengths, usually from ½ to 2 inches in diameter; the central woody portion is often removed by splitting the bark on one side. The exterior surface has a twisted rope-like or columnar appearance, and is of a dull grey colour, a transverse section shows a porous surface of a dirty white colour, and loaded with pale yellowish-white resin; through this substance pass numerous bundles composed of large vessels and woody fibre. The drug is free from smell, but has a nauseous taste, which is only perceptible after it has been some time in the mouth. In some specimens all or a portion of the central wood remains; it resembles a piece of rattan cane. Black *nisot* presents a similar appearance, but is of smaller size and of a darker colour.

Microscopic structure.—The epidermis consists of tabular brown cells; the parenchyma is starchy, in it are thickly scattered very large resin cells and numerous rosette-like raphides; the many large vascular bundles are composed of large dotted vessels surrounded by wood fibres, each of the prominent external ridges of the bark contains one of these bundles.

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The central cane-like woody column of the root or stem when present is seen to be divided into four parts by four bands of parenchyma (medullary rays); it consists of large dotted vessels connected together by narrow portions of woody fibre.

The black *nisot* has exactly the same structure as the white.

Chemical composition.—Turpeth resin consists of a small quantity of soft resin soluble in ether, and of a substance insoluble in ether, benzine, bisulphide of carbon and essential oils. This substance has been named *Turpethin* ($C^{34}H^{56}O^{16}$), and is present in the root to the extent of 4 per cent.; it has been examined by Spirgatis, who describes it as a grey powder having a powerfully irritant action upon the mucous membranes of the mouth and nose, and being analogous in its reactions with jalapin and convolvulin. Under the action of alkaline bases it is transformed into turpethic acid, and in the presence of hydrochloric acid becomes converted into glucose and turpetholic acid. (*Zeitschr. der Chemie und Pharmacie*, 1865.) Turpeth resin is supposed to have a resemblance in colour and action to *Turpeth mineral*, an old name for basic sulphate of mercury.

Commerce.—The price of the drug in Bombay is about Rs. 2 per maund of 37½ lbs.

IPOMÆA HEDERACEA, *Jacq.*

Fig.—*Jacq. Icon.*, *t.* 36; *Bentl. and Trim.*, *t.* 185. Syn.—*Pharbitis Nil*, Chois.

Hab.—Throughout India. The seeds.

Vernacular.—Mirchai, Káladana (*Hind.*), Nil-kolomi, Káladana (*Beng.*), Kodi-kákkatan-virai, Jiriki-virai (*Tam.*), Jiriki-vittulu, Koili-vittulu (*Tel.*), Káladana (*Guz.*), Nilapushpiche-bij (*Mar.*). The same vernacular names are often applied to the seeds of *Clitorea ternatea.*

History, Uses, &c.—These seeds do not appear to be noticed in Sanskrit works on Materia Medica. Under the Arabic name Hab-un-níl and the Persian name Tukm-i-níl, the author of the *Makhzan-el-Adwiya* correctly describes the

shape of the seeds, and colour of the flowers. As regards the medicinal properties of the drug he says that it is a drastic purgative and attenuant, relieving the system of bilious and phlegmatic humours, and acting as an anthelmintic. In some native works the seeds of *Clitorea ternatea* appear to be confounded with Káládána. The author of the *Makhzan*, though describing the latter article correctly, gives Aprajita (*Clitoria ternatea*) as the name of a kind of Hab-un-nil.

From the time of Roxburgh, and probably from an earlier date, the properties of the seeds have been known to Europeans, who have almost universally acknowledged their value as a safe and sure cathartic.

In the *Pharmacopœia of India* (1868) they were made official, and directions for preparing an extract, tincture, compound powder, and resin are given. These preparations are meant to supply the place of similar preparations of jalap. With regard to the extract, we would observe that no directions for separating the albumen and mucilage are given, consequently the result of the operation is an enormous bulk of almost inert extract, which in a short time becomes putrid. Five to ten grains of this extract have no perceptible effect as a purgative. The resin, first prepared by Dr. G. Bidie of Madras in 1861, appears to be the most satisfactory preparation; of this the dose is from 4 to 8 grains.

Description.—The seeds resemble in shape those of most of the Convolvuli, being in the form of a segment of a sphere; they are generally about $\frac{3}{16}$ of an inch in length, and nearly as much in breadth, but sometimes much smaller. Their weight varies from $\frac{1}{2}$ to nearly 1 grain. The colour of the testa is black, except at the umbilicus, where it is brown. Upon soaking the seeds in water the testa bursts and discloses the delicate albumen which envelopes the folded cotyledons and radicle. These have an acrid taste and earthy odour.

Microscopic structure.—From without inwards the testa consists of—1*st*, a layer of epithelial cells, the thick outer walls of which form conical projections; 2*nd*, a single layer of smal

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quadrangular cells; 3*rd*, a layer of radially elongated prismatic cells; 4*th*, a zone of parenchyma, the cells of which are irregularly compressed. Within the testa is the thin layer of albumen, which contains much mucilage. The cotyledons are built up of polygonal cells; in their substance are cavities or passages which contain a yellowish oil.

Ipomœa muricata, *Jacq., Hort. Schoenb. iii.* 40, *t.* 323, *Bot. Reg. iv., t.* 290, a native of Persia and the Himalayas, is the source of the Tukm-i-níl imported into Bombay from Persia. Roxburgh says of it :—" I have only met with this in my own garden; it was raised from seeds sent from Persia and proves annual." It is noticed by Graham, who seems to regard it as a variety of *Calonyction speciosum* (*Bombay Plants,* No. 972). In Bombay it is common in gardens and upon waste ground, and it is a garden weed in many parts of the Concan, where it is known as *Bárik Bhauri,* or the lesser Bhauri, on account of the similarity of the calyx to that of *Porana racemosa* (Bhauri). The juice of the plant is used to destroy bugs. The Bombay plant is identical with the one we have obtained by sowing the Persian seed.

Description.—Annual herbaceous, climbing; root small, tapering, with many slender rootlets; stem branched, covered with soft prickles, not hairy; leaves broadly cordate, acuminate, smooth, on long petioles; flowers axillary, 2 to 4, on long peduncles having prickles like the stem; pedicles large, fleshy and club-shaped, of a light green colour, 1½ inches long; calyx divided; sepals 5, broadly ovate, mucronate, smooth, persistent; corolla purple, about 2 inches in diameter, expanding at sunset, and closing before sunrise; capsule two-celled, composed of 4 segments, which separate from the central partition; cells two-seeded; seeds dark brown, smooth, the same shape as those of Kaladana, about ⅓rd of an inch in length, and ¼ in breadth; weight about 3 grains each. They can easily be distinguished from Indian Kaladana by their greater size, lighter colour and thick testa; their medicinal properties appear to be identical with those of *I. hederacea.*

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Chemical composition.—The authors of the *Pharmacographia* say:—"By exhausting the seeds dried at 100° C., with boiling ether, we obtained a thick light-brownish oil having an acrid taste and concreting below 18° C. The powdered seeds yielded of this oil 14·4 per cent. Water removes from the seeds a considerable amount of mucilage, some albuminous matter, and a little tannic acid. The first is soluble to some extent in dilute spirit of wine, and may be precipitated therefrom by an alcoholic solution of acetate of lead.

"The active principle of Kaladana is a resin, soluble in alcohol, but neither in benzol nor in ether. From the residue of the seeds after exhaustion by ether, treatment with absolute alcohol removed a pale yellowish resin in quantity equivalent to 8·2 per cent. of the seed. Kaladana resin, which has been introduced into medical practice in India under the name of *Pharbitisin*, has a nauseous acrid taste and an unpleasant odour, especially when heated. It melts at about 160° C. The following liquids dissolve it more or less freely, namely, spirit of wine, absolute alcohol, acetic acid, glacial acetic acid, acetone, acetic ether, methylic and amylic alcohol and alkaline solutions.

It is, on the other hand, insoluble in ether, benzol, chloroform, and sulphide of carbon. With concentrated sulphuric acid, it forms a brownish yellow solution, quickly assuming a violet hue. This reaction, however, requires a very small quantity of the powdered resin. If a solution of the resin in ammonia after having been kept a short time is acidulated, no precipitate is formed; but the solution is now capable of separating protoxide of copper from an alkaline solution of the tartrate which originally it did not alter. Heated with nitric acid, the resin affords *sebacic acid.*

"From these reactions of Kaladana resin, we are entitled to infer that it agrees with the resin of jalap or *Convolvulin.* To prepare it in quantity, it would probably be best to treat the seeds with common acetic acid, and to precipitate it by neutralising the solution. We have ascertained that the resin is not decomposed when digested with glacial acetic acid at 100° C., even for a week.

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"We have had the opportunity of examining a sample of Kaladana resin manufactured by Messrs. Rogers and Co., Chemists of Bombay and Poona, which we found to agree with that prepared by ourselves. It is a light yellowish friable mass, resembling purified jalap resin, and, like it, capable of being perfectly decolorised by treatment with animal charcoal." (*Op. cit.*, 2nd Ed., p. 449.)

Commerce.—Kaladana is collected in different parts of the country; the plant is everywhere common during the latter part of the rainy season.

In the Bombay market the seeds of *Ipomœa muricata*, Jacq., imported from Persia, are much more common than those of the true Kaladana. They are accepted by the natives as Kaladana. Value, Rs. 5 per maund of 37½ lbs.

IPOMÆA DIGITATA, *Linn.*

Fig.—*Rheede Hort. Mal. xi.*, 49; *Bot. Reg.*, *t.* 62, *Bot. Mag.*, 1790. Syn.—*Batatas paniculata.*

Hab.—Tropical India. The root.

Vernacular.—Bidári-kand, Bilái-kand (*Hind.*), Bhumi-kumra (*Beng.*), Bhui-kohola, Pattána (*Mar.*), Bhui-koholu (*Guz.*), Matti-pál-tiga (*Tel.*), Nela-gumbala, Buja-gumbala (*Can.*), Pál-modekka (*Mal.*), Nelli-kumbalu (*Tam.*).

History, Uses, &c.—This plant is mentioned by the early Sanskrit writers on medicine under the names of Vidári and Bhumi-kushmánda. In the Nighantas it bears numerous synonyms, such as Payas-vini, "abounding in milk"; Vriksha-valli, "tree-creeper"; Ikshu-valli and Kshira-vidári. The name Bhumi-kushmánda signifies "earth gourd," and is applied to *I. digitata*, from a supposed resemblance between its large tuberous root, and the gourd of *Benincasa cerifera.* The vernacular names Bhumi-kumra and Bhui-kohola have the same meaning; in Hindi Bilai signifies a "pumpkin scraper," and kand "a tuberous root," and in Malayalim pál signifies "a milky juice," and modekka "a gourd."

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The large tuberous root is considered tonic, alterative, aphrodisiac, demulcent, and lactagogue. In the emaciation of children with debility, and want of digestive power, the following diet is recommended:—"Take of Vidari, wheat flour and barley equal parts, and make into a confection with milk, clarified butter, sugar, and honey." Susruta gives several prescriptions for its use as an aphrodisiac. The simplest is as follows:—"Macerate the powder of the root in its own juice, and administer with honey and clarified butter. Vidari enters into the composition of several diuretic and demulcent mixtures."

In the Concan the root is peeled and cut in small pieces and dried in the shade, it is then powdered and the powder repeatedly moistened (14 times) with the juice of the fresh root and dried. Half a tolá of this preparation may be taken daily in honey or milk as an aphrodisiac. From this powder a *Paushtik* is made by frying it in butter with equal parts of almonds, quince seeds, cloves, cardamoms, nutmegs, satawari, gokhroo, seed of *Mucuna pruriens*, músli, &c., and making the whole into a conserve with sugar. This conserve is taken dissolved in milk in doses of half a tolá or more, as an aphrodisiac. In spermatorrhœa the juice is given with cumin and sugar, and as a lactagogue it is combined with coriander and fenugreek. Rheede says:—"Radix in sole siccata, trita, in pulverem redacta, cum saccharo et butyro decocta et assumpta, macilentos fertur reddere et obesos; sed et immodicum mensium sistit fluxum, et in febribus ossium confert."

Description.—The root is a simple or branched tuber, sometimes as much as 40 to 50 lbs. in weight, externally it is of a brown colour, and somewhat warty and scabrous. When a transverse section is made the cut surface is of a dirty white colour, and marked by concentric rings, which are formed by the vascular and laticiferous vessels; from the latter a viscid milky fluid exudes; the taste is astringent and somewhat acrid, not unlike raw potato. The bulk of the tuber consists of a starchy parenchyme. The vascular system is scalariform.

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The laticiferous vessels are most numerous towards the cortical part; raphides abound.

Chemical composition.— The fresh tuber, collected in November when the vine had died away, was sliced, dried at a low temperature and reduced to fine powder. The powder dried at 100°C., yielded 2·68 per cent. of extractive to absolute alcohol of which 1·73 per cent. was soluble in ether. The resins contained in the alcoholic extract had the properties of Jalap resins as regards colour, reactions, &c.; but we are unable to say whether they possess any purgative action. Sugar, reducing alkaline copper solution on boiling, was present to the extent of 10·909 per cent. calculated on the anhydrous tubers. The bulk of the tuber consists of starch. Supposing the resins to be purgative, they are present in so small a proportion that no ordinary dose of the root would have any aperient action.

IPOMÆA BILOBA, *Forsk.*

Fig.—*Rheede Hort. Mal. xi., t.* 57; *Bot. Reg.*, 319. Syn.—*I. pescapræ.* Goat'sfoot Convolvulus (*Eng.*).

Hab.—Coasts of India and Ceylon. The root and leaves.

Vernacular.—Dopátilata (*Hind.*), Chhágal-khuri (*Beng.*), Marjádvel (*Mar.*), Ravara-patri (*Guz.*), Balabandi-tiga, Chevulapilli-tigá (*Tel.*), Kutherai-kolapadi, Anttoo-kala-dumbo, Adapu-kodi (*Tam.*), Adambu-balli (*Can.*).

History, Uses, &c.—Vriddhadáraka is the name of a drug in use throughout India; it is a twisted root about half an inch in diameter, upon the broken or cut ends of which may be observed a black, concreted juice. It is supposed to strengthen the body and prevent the effects of age (Vriddha dáraka). Dutt states that in Bengal the root of *Argyreia speciosa* is used, but the drug sold as Vardhára in Western India is not the root of this plant; it appears, however, to be obtained from a plant of the same order, but, as is usually the case in India, the herbalists will not indicate the source from which they obtain it. If we turn to the Nighantas we find the following syno-

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nyms for Vriddhadáraka :—Chhagala, Chhagalánghri, "goat's foot"; Chhagalándi, "goat's testicles;" Chhaggalántri, "goat's guts;" Antri, Raksho-ghna, Dirgha-mulaka, Anda-kotara-pushpi, Durga and Mahasyama. From these names it would appear that the "goat's foot convolvulus" is the plant which ought to be used. Vriddhadáraka is described as astringent, hot, pungent, alterative, tonic; a remover of rheumatism, dropsy, gonorrhœa and phlegm. These properties agree very nearly with those ascribed to *I. biloba*, the leaves of which boiled are applied externally in rheumatism and colic; whilst the juice is given as a diuretic in dropsy, and at the same time the bruised leaves are applied to the dropsical part. Rheede, speaking of *I. biloba*, which he calls *Schovanna Adambu*, states:—"In aqua decocta fomentum exhibet quo dolores arthritici mitigantur. Folia cum lacte caprarum in potionem præparata, pro hæmorrhoidibus propinantur."

According to P. S. Mootooswamy, the leaves are used as a cataplasm in phlegmon, &c. Plumier states that the dried juice of the root is used as a purgative in the Brazils in doses of 12 to 14 grains, and that it should be given like jalap resin with ginger and bitartrate of potash.

I. biloba is sacred to Durga, and the Kolis on the Western Coast, on the sixth day after a child is born, decorate its cradle with the flowers to propitiate that goddess, who, under the name of Shashti, is supposed to destroy newborn children. In this respect it also agrees with the description of Vriddhadáraka. The Brahminical name for the plant given by Rheede is बांगडिवल्ली, a combination of the Marathi word Bángadi, "a coil of rope or bangle," and the Sanskrit Valli, "a creeper."

Description.—A perennial plant with a tough woody root of great length; it abounds in sandy ground near the sea-shore; from the enlarged crown of the root grow a number of creeping stems, fleshy and purplish when young, but becoming woody as they mature; the leaves are smooth, thick, long petioled, and two-lobed like those of the Bauhinias; the flowers large, and of a reddish purple. A section of the root shows

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in the central portion five wedge-shaped bundles of fibro-vascular tissue; external to these is a row of laticiferous vessels full of a viscid yellow latex, then again come a number of irregularly placed fibro-vascular bundles, and external to them another zone of laticiferous vessels. The parenchyme of the root contains starch and large conglomerate raphides. The whole plant is very mucilaginous.

Chemical composition.—The powdered roots, dried at a low temperature, were exhausted with 80 per cent. alcohol: the tincture exhibited a slight greenish yellow fluorescence. The tincture was freed from alcohol by spontaneous evaporation, and the extract mixed with water, acidulated with sulphuric acid and agitated with benzole. During agitation, a brownish soft resin separated; this resin was insoluble also in ether, but dissolved in alkalies with a dark yellowish brown coloration, and was precipitated by acid in brown flocks. The benzole solution left on spontaneous evaporation a viscid transparent residue of the colour and consistence of Venice turpentine, which possessed a slight odour of peppermint. This extract was soluble in absolute alcohol with greenish yellow fluorescence and was neutral in reaction: it was also soluble in ether, with similar fluorescence. The alcoholic solution gave with ferric chloride a dirty greenish precipitate. In cold 5 per cent. caustic soda it was insoluble, but on boiling it dissolved with some difficulty, affording a dark yellowish solution, while an odour not unlike that of aniseed was noticed. The cold caustic soda solution on agitation with ether afforded a small amount of yellowish white oily extractive with an odour of aniseed. The caustic soda solution on the addition of dilute acids afforded a yellowish precipitate. The original acid aqueous solution was next agitated with ether. The extractive was small in amount, partly in the form of a transparent varnish adhering to the sides of the capsule, and partly in indistinct whitish crystals. Heated with water, a portion dissolved, affording a clear solution, but which became turbid on cooling from a deposit of yellowish flocks, which on microscopic examination were not found to exhibit a crys-

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talline structure; we only detected minute globules. The aqueous solution was strongly acid in reaction, and gave with ferric chloride a dirty greenish coloration, with lime water a bright yellow coloration, and with basic acetate of lead a sulphur-yellow precipitate. This principle, soluble in water, and reprecipitated on cooling, is probably allied to the Quercitrin group of principles. That portion of the residue insoluble in water, was in properties similar to the resin dissolved by benzole.

The aqueous acid solution was lastly rendered alkaline and agitated with ether. The ethereal extract was not more than a trace, but afforded all the reactions in a marked degree of an alkaloidal principle.

The leaves also afforded marked evidence of the presence of an alkaloidal principle soluble in ether, and probably similar to the one we detected in the roots.

Several other species of *Ipomœa* are considered by the natives of India to have medicinal properties. **I. reniformis,** *Chois*, *Burm. Fl. Ind.* 77, *t.* 30, *f.* 1, is said to be deobstruent and diuretic; the juice is administered in rat-bite, and is supposed to cure sores in the ear. The plant is called Músha-karni, "rat's ear," in Sanskrit, from the resemblance of its leaves to the ear of that animal. The vernacular names Undirkáni, Mushkani, &c., have the same meaning. Its properties appear to us to be more fanciful than real, though, like others of the genus, it is purgative if taken in large doses.

Description.—Stem creeping and rooting; leaves kidney-shaped, waved, and dentate on the margin, obtuse; petioles hairy; peduncles very short, 1 to 2-flowered; corolla small, yellow. Common in places where water has lodged; flowers in the cold weather. At a little distance the plant has the appearance of *Hydrocotyle asiatica*.

I. vitifolia, *Sweet.*, *Burm. Fl. Ind.* 45, *t.* 18, *f.* 1, is a large perennial climbing plant, with cordate, palmately 5-cleft leaves, and large, bright yellow flowers, the juice of which is considered to be very cooling, and is administered with milk and

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sugar; it is also applied locally to inflamed eyes, mixed with limejuice one part, opium ½, and Mámirán (Coptis root) ¼.

I. Quamoclit, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 60, a small twining plant, easily recognised by its filiform, pectinate leaves, and small bright crimson or white flowers, is considered by the Hindus to have cooling properties; they apply the pounded leaves to bleeding piles, and at the same time administer one tolá of the juice with an equal quantity of hot *ghi* (clarified butter) twice a day internally. The crushed leaves are also applied as a *lép* (plaster) to carbuncles.

The Sanskrit name is Kámalata, "Cupid's flower." (See *As. Researches*, iv., p. 256.) The Marathas call it Sita-che-kes, "Sita's locks."

I. sinuata, *Ortega*, a native of Tropical America introduced in the North-West Provinces, is the "Noyeau Plant." The leaves have an odour of oil of bitter almonds, and are used in the preparation of the French Liqueur known by that name.

I. campanulata, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 56, is said to be an antidote to snake-poison.

I. sepiaria, *Koen.*, *Rheede Hort. Mal. xi.*, *t.* 53, has a reputation as an antidote to arsenic; the juice, which is strongly acid, is said by Rheede to be used "*ad purificationem corporis.*"

I. pes-tigridis, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 59, is supposed to be an antidote to the poison of mad dogs; pounded with butter, it is applied to disperse boils and carbuncles.

I. uniflora, *Roem. et Sch.*, *Rheede, Hort. Mal. xi.*, *t.* 54, is purgative, and the juice is administered in bilious dyspepsia.

I. aquatica, *Forsk.*, *Rheede, Hort. Mal. xi.*, *t.* 52, is commonly used as a vegetable. It is called Kalambi in Sanskrit, Kalmi-sák in Bengali, and Náli-chi-bhájí in Marathi.

I. bona-nox, *Linn.*, *Convolv. Or.* 59, *t.* 1, *f.* 4, is the Moon-flower.

The pericarpium of this species of Convolvulus contains usually four seeds about the size of kidney beans, which are

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eaten when young. Dried, these capsules and seeds, as well as the flowers, leaves and root, are amongst the medicines which are supposed to have virtues in snake-bites; the dose of the seeds is about three daily, administered in powder. (*Ainslie.*) The capsules have been sent to us from Poona as being in use there. In the Concan the juice of Rivea ornata, Phánd (*Mar.*), is made with Borneo camphor and butter into an ointment for pityriasis. For piles, one tolá of the juice with half a tolá of Babul pods, and a little sugar, is given in a quarter seer of cow's milk every morning.

ARGYREIA SPECIOSA, *Sweet.*

Fig.—*Wight Ic., t.* 851; *Bot. Mag.* 2446. Elephant-creeper (*Eng.*).

Hab.—Throughout India. The leaves and root.

Vernacular.—Samandar-sokh (*Hind.*), Bijtarka (*Beng.*), Samudra-shok (*Mar.*), Shamuddira-pachchai, Kadal-pála (*Tam.*), Samudra-pála, Kokkita (*Tel., Can*), Samudra-pachcha, Samudra-yogam (*Mal.*), Samudra-sosha (*Guz.*).

History, Uses, &c.—The root of this large climbing plan which is called Samudra-sosha in Sanskrit, is used as a substitute in Bengal for the drug described under the name of Vriddhadáraka, a drug which we have already noticed as having been originally the root of *Ipomœa biloba.* The large leaves, which have the under-surface covered by a thick layer of silky hairs, afford a kind of natural impermeable piline, and are used as a maturant by the natives. With regard to the alleged blistering properties of the upper surface of the leaf there must be some mistake, as we find it has no effect when applied to the skin.

Description.—Leaves heart-shaped, 9 to 12 inches long and 8 to 10 broad, or even larger; upper surface dark green and smooth, under-surface white and silky from the presence of a felted layer of long simple hairs. Under the microscope these are seen to be simple tubes gradually tapering to a point,

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and much like the fibre of flax; they are very strong and not easily removed by pulling or scraping; they retain moisture well.

The roots are long, woody and tough, covered with a dark brown bark; on transverse section they present a central porous woody column, and several concentric rings of woody fibre, between which are situated portions of parenchyma. In the woody portions of the root there are large laticiferous vessels which contain a yellowish latex. The vascular system consists of very large dotted vessels. In the parenchyme are numerous conglomerate raphides.

Chemical composition.—The roots yielded acid resins of an amber colour, soluble in ether and benzole, and partly soluble in alkalies. The acid ether extract was partly soluble in water with strong acid reaction, and gave with ferric salts a grass-green coloration; with alkalies a bright yellow. The portion insoluble in water was soluble in alkalies with orange coloration, and afforded with acids a yellowish-white precipitate. The original aqueous solution after addition of an alkali and agitation with ether, failed to afford any alkaloidal reactions when the ethereal extract was tested. This extract did not amount to more than a trace. The original aqueous solution contained a tannin-like principle.

CONVOLVULUS ARVENSIS, *Linn.*

Fig.—*Eng. Bot. v., t.* 312; *Bulliard Herb. Fr., t.* 269. Small Bindweed (*Eng.*), Liseron des champs (*Fr.*).

Hab.—Western India from Cashmere to the Deccan. Most temperate climates. The root.

Vernacular.—Hiranpad, Hiranpadi (*Hind.*), Hiranpag (*Guz., Sind.*), Naranji (*Can.*).

History, Uses, &c.—This common weed of cultivation is the *Helxine Cissampelos* of Matthiolus (*Valgr.* 2, 359). Helxine (ἑλξίνη) is a Greek name for a plant described by Dioscorides (iv. 87), and apparently of two different plants, mentioned by Pliny and Paulus Ægineta, which have not been

satisfactorily identified. Roxburgh describes *C. arvensis* under the name of *C. Malcolmi*; his plant was raised from seeds brought from Persia by Major Malcolm in 1801. Stewart and Aitchison notice the occurrence of the plant in the Punjab. Dr. Gibson states that it is very common on the black soil of the Deccan, flowering during the rains. The root is used as a purgative in the Punjab and Sind.

Description.—Root perennial; stems and branchlets twining to an extent of six or eight feet, somewhat furrowed, twisted, and villous, herbaceous; leaves petioled, sagittate, margins a little hairy, smooth on both sides, from 1 to 3 inches long; barbs or posterior lobes dilated, spreading, somewhat acute, often dentate, and always angular; petioles scarcely half the length of the leaves, channelled; peduncles axillary, 2-flowered, three times longer than the petioles, round; pedicels clavate, as long as the petioles, villous; bracts two, opposite, at the base of the pedicels, lanceolate; calycine leaflets ovate; corol large, of a beautiful lively pink colour, margins almost entire; filaments not half the length of the corol, villous at the base; anthers purple; germ with a yellow ring round the base; style longer than the stamina; stigma of two linear, spreading lobes. (*Roxburgh.*)

Chemical composition.—This plant, like many others of the genus, contains convolvulin.

EVOLVULUS ALSINOIDES, *Linn.*

Fig.— *Lam. Ill.*, *t.* 216, *f.* 2; *Wight Ill.*, *t.* 168; *Rheede, Hort. Mal. xi.*, *t.* 64.

Hab.—Throughout India and Ceylon. The herb.

Vernacular.—Vishnukránta (*Hind.*), Shankavéli (*Mar.*), Vistnukrandi (*Tam.*, *Can.*), Vistnukrandum (*Tel.*).

History, Uses, &c.—This plant is the Vishnu-kránta, "Vishnu's step," of Sanskrit writers. In the Nighantas it bears the synonyms of Nila-pushpa, "blue flowered," Jaya and Parájita; it is described as bitter, cephalic, anthelmintic, anti-

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phlegmatic and antiphlogistic. In Vedic times it was thought to promote conception. At the present time it is thought to strengthen the brain and memory, and is used extensively as a febrifuge and tonic. Rheede calls it Vishnu-clandi, an evident corruption of the Sanskrit name; he states that it is used as a febrifuge with cumin and milk, also as an alterative, and with oil to promote the growth of the hair. According to Ainslie, the leaves, stalks, and roots are all used in medicine by the Tamools, and are supposed to possess virtues in certain bowel affections; they are prescribed in infusion in the quantity of half a teacupful twice daily. Burmann says that it is reputed to be a sovereign remedy for dysentery.

Description.—A very small herbaceous plant, cæspitose, procumbent, covered with adpressed hairs; leaves ovate-oblong, subsessile, less than ½ inch long; peduncles one-flowered, as long as the leaf or longer; flowers of a beautful deep blue, very small. Common everywhere in grassy places.

Chemical composition.—Ether separated from the powdered herb a yellow neutral fat of the consistence of vaseline. The alcoholic extract contained an alkaloid of a slightly bitter taste, and affording no colour reactions with strong mineral acids. An organic acid of a deep red brown colour occurred in the water extract, and formed an uncrystallizable compound with lead. A quantity of saline matter was present in this drug.

SAKMUNIYA or BAZAR SCAMMONY.

This substance is all fictitious, and is said to be made in Surat; nevertheless it was for many years purchased by the Medical Store Department in Bombay under the impression that it was genuine Scammony! (See *Pharmacopœia of India*, p. 447.) It usually occurs in irregular fragments of a bright green colour, somewhat translucent at the edges, and having a resinous fracture. Rectified spirit dissolves the resin, and leaves a residue of green colouring matter and gum; the former is evidently of vegetable origin.

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Sometimes a black Sakmuniya is met with; this is also spurious, and is resinous in taste and smell, but has a more earthy appearance than the green variety. Rectified spirit dissolves out a quantity of resin, and leaves a black residue which, under the microscope, is seen to be made up of tufts of vegetable hairs, numerous small carbonaceous particles, and small irregular crystalline particles. Treated with dilute hydrochloric acid it effervesces feebly after a short time; with strong acid it effervesces strongly at once, and forms a green solution.

The Persians call Scammony Mahmudah. Mir Muhammad Husain in the *Makhzan* gives a good description of it and the plant which produces it. He tells us that artificial Scammony is made from the juice of *Calotropis gigantea*, mixed with the flour of a kind of pulse called in Persian '*Karsanah.*' His account of the uses of the drug does not differ materially from that given in European works, with the exception that Scammony when baked is said to lose its aperient properties and to act as a powerful diuretic The baking process consists in enclosing the powdered drug in a bag, and then placing the bag inside an apple or quince which has been hollowed out for the purpose, the apple is then enclosed in dough like a dumpling and baked in an oven.

CRESSA CRETICA, *Linn.*

Fig.—*Lam. Ill., t.* 183; *Sibth. Fl. Græc., t.* 256.

Hab.—Throughout India. Common on the West Coast.

Vernacular.—Rudravanti, Rudranti (*Hind., Beng.*), Khardi, Chavel (*Mar.*), Una (*Guz., Sind.*).

History, Uses, &c.—This plant is the Rudantika and Amrita-srava of Sanskrit writers, and is believed to exude moisture, since the ground in its neighbourhood is always moist, and ants are always to be found near it. Medicinally it is

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considered to be exhilarating, and to purify the blood and give tone to the system. It is prescribed in decoction as a tonic, and is believed to possess expectorant and antibilious properties.

C. cretica is found in Greece, and is supposed to be the first kind of ἀνθυλλίς mentioned by Dioscorides (iii., 144); it is described as growing in sandy ground, and having a salt taste, and was used as a diuretic and to disperse swelling and phlegmatic humors. Paulus Ægineta and Pliny also mention it. Mahometan physicians copy what the Greeks have said about the two kinds of anthyllis, but give no Arabic or Persian name for the drug, and those who have written in India do not identify it with the Rudantika of the Hindus. It appears to retain its place in their Materia Medica solely because of its repute among the Greeks.

Description.—A very small, shrubby, diffuse plant; leaves ovate, sessile, very small, acute, numerous, ashy or hoary-pubescent; flowers small, white or pink, sub-sessile, in the superior axils, forming a many-flowered head. It is very common in rice fields about Bombay in the cold weather, and is much used by gardeners for making bouquets. The plant has a bitter and saline taste. According to Retz and Roxburgh the Indian plant differs from the common form of *C. cretica* in having 4 seeds.

Chemical composition.—The plant contains an alkaloid soluble in ether, which fails to afford any special colour reactions; its solution is not precipitated by chromates. It is not bitter. There is nothing else in the plant of special interest.

AFTIMUN.

This is the Arabic form of the Greek word ἐπίθυμον, "growing on thyme," a name applied by Dioscorides to a plant growing in Cappidocia and Pamphylia, which was used for purging the body of pituitous humors and black bile (iv. 172). His description of it is so unsatisfactory that it is doubtful whether

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he is speaking of the flowers of a kind of thyme, or of a parasitic plant growing on thyme. Pliny (26, 35), commences by speaking of *Epithymon* as the blossom of a sort of thyme similar to Savory, but ends by saying—"Some persons, again, give a different description of epithymon: according to them, it is a plant without a root, diminutive, and bearing a flower resembling a small hood, and of a red colour." Epithymon is generally identified with *Cuscuta Epithymum*, Linn., the Lesser Dodder, a parasitic plant upon Heath, Furze, Thyme and other small shrubby plants. (See *Fl. Br.* 283; *Fl. Dan. t.* 427.) The plant used medicinally in India as *Aftimun* is imported from Persia, and appears to be a larger species, probably *C. europea*, Linn., which is a native of Europe and of Western and Central Asia. Mahometan physicians consider this drug to be alterative and depurative, a purge for bile and black bile, useful in all affections of the brain such as fits, melancholy, insanity, &c. They also describe it as carminative; and apply it locally as an anodyne. The author of the *Makhzan-el-Adwiya* devotes a whole folio page of small print to a description of its properties and uses. In modern medicine the different species of Cuscuta are no longer used.

Chemical composition.—In addition to quercetin, which was present in large amount, and resins, an alkaloidal principle was isolated, slightly bitter, soluble in ether, but more easily dissolved by chloroform. This alkaloid did not afford any special colour reactions. We provisionally call it *Cuscutine*.

KUSHOOTH, *vulg.* KASOOS.

Kushooth (كشوث) is the Arabic name for the Dodders, and from it have been derived the Greek κασσυθα and Latin Cuscuta of mediæval writers.

An Arabian poet says:—

هو الكشوث فلا اصل ولا ورق .·.
ولا نسيم ولا ظل ولا ثمر .·.

"He is like the Kashooth; for he has neither root, leaves, fragrance, shade or fruit."

In the Indian bazars the name is applied to the fruit of a species of Cuscuta, imported from Persia, and also called *Tukm-i-kasús*; it is mixed with the small oblong leaves and spines of the plant upon which it has grown, and the flowers and portions of the stem may often be found. The seeds are four in number, light brown, convex on one side, concave on the other, and enclosed in a nearly globular capsule about the size of a radish seed. The taste is bitter. Mir Muhammad Husain identifies this drug with the *Amal-bel, Akás-bel*, or *Amarlata* of India, and describes it as yellow, growing on thorns and other shrubs, and as having a very small, whitish flower, and seeds rather smaller than radish seeds, nearly round, and of a reddish yellow colour. Its properties are described as much the same as those of Aftimun. The plant may be either *C. hyalina*, Roth., *C. chinensis*, Lam., or *C. planiflora*, Tenore; possibly several species are collected. In India *C. reflexa*, Roxb., is sometimes used; it is a larger plant, and has larger fruit than the imported article.

Chemical composition.—In addition to quercitrin, we separated a bitter and glucosidal resin, insoluble in ether, but soluble in amylic alcohol, and also somewhat soluble in water. With basic acetate of lead, after the solution of the resin in alkalies, a light yellow precipitate was afforded; but when the alkaline solution was exposed to air, the precipitate with basic lead was of the colour of chromate of silver. An alkaloidal principle was also present in traces which failed to give any special colour reactions. The presence of a principle in traces possessing a marked rhubarb-like odour was detected; this principle did not appear to exist ready formed in the seeds, but was a product of the action of dilute acids on an undetermined principle: it was soluble in ether and benzole. Astringent matter affording a plum-coloured precipitate with basic acetate of lead was also present; as well as wax, and a certain amount of oil.

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SOLANACEÆ

SOLANUM NIGRUM, *Linn.*

Fig.—*Wight Ic. t.* 344; *Jacq. Pl. Rar. ii., t.* 326; *Rheede, Hort. Mal. x., t.* 73. Garden Nightshade (*Eng.*), Morelle noire (*Fr.*).

Hab.—Throughout India and Ceylon. All temperate and tropical parts of the world. The herb in fruit.

SOLANUM DULCAMARA, *Linn.*

Fig.—*Bentl. and Trim. t.* 190. Bitter-sweet Nightshade (*Eng.*), Douce amère, Vigne vierge (*Fr.*).

Hab.—Temperate W. Himalaya, Europe, Central Asia. The herb in fruit.

Vernacular.—*S. nigrum*: Makoi, Gúrkamai (*Hind.*), Kák-máchi (*Beng.*), Kámuni (*Mar.*), Pilúdu (*Guz.*), Manatta-káli (*Tam.*, *Mal.*), Kánchi-chettu, Kámanchi-chettu (*Tel.*), Kánchi, Ganikè (*Can.*). *S. dulcamara*: Inab-es-sálib (*Ind. Bazars*).

History, Uses, &c.—The Sanskrit names Káka-máchi, Kákamáta, Dhvánksha-máchi, Jaghana-phala and Kinkini are probably applicable to both of these plants; whilst the vernacular names, with the exception perhaps of the Hindi, are only applicable to *S. nigrum*. In the Nighantas the drug is described as emollient, hot, sweet, strengthening, cardiacal and alterative; a useful remedy in dropsy, skin diseases, piles, fever, gonorrhœa, and inflammatory swellings. In a preparation called *Hridayarnavarasa* it is combined with mercury and sulphide of copper as a remedy in heart disease. In India at the present time *S. nigrum* is in general repute as a remedy for skin diseases, and as a local application to rheumatic and gouty joints. It is also valued as a diuretic. Under the name στρύχνος or τρύχνος the Greek physicians describe several Solanaceous plants, one of which, the στρύχνος κηπαῖος or

"Garden nightshade" of Dioscorides (iv. 69) appears to agree well with *S. nigrum*. He distinctly states that it may be eaten without danger, and describes it as very cooling whether applied externally or administered internally. It appears to have been used chiefly by the Greeks as a local application to inflamed parts.

Haji Zein-el-Attár, under the name of Inab-eth-thálib, "fox's grapes," in Persian Rúbah-turbak, and Sag-angur "dog's grapes," describes a kind of nightshade with yellowish red berries having similar properties, which he also says is useful in dropsy as a diuretic; he concludes with a caution against the use of another kind with black berries which causes delirium and is highly poisonous. In cases of poisoning by the latter plant he directs an emetic to be administered, and milk, or honey and water with aniseed and bitter almonds to be given. Most Arabian and Persian writers on Materia Medica describe the four kinds of στρύχνος mentioned by Dioscorides as varieties of Inab-eth-thalib, and copy from Greek writers, but they only appear to have used the first and second kinds medicinally, viz., *Solanum nigrum* or *dulcamara*, and *Physalis Alkekengi*, commonly known as Kákanaj. The Inab-eth-thálib of the present day, imported from Persia, consists entirely of the red berries of *S. dulcamara*. In India the juice of *S. nigrum* is given in doses of from 6 to 8 ounces in the treatment of chronic enlargements of the liver, and is considered a valuable alterative and diuretic. The juice after expression is warmed in an earthen vessel until it loses its green colour and becomes reddish brown; when cool it is strained and administered in the morning. It is said to act as a hydrogogue cathartic and diuretic. Mr. M. Sheriff in his Supplement to the *Pharmacopœia of India* speaks very favourably of it when used in this way. In smaller doses (1 to 2 ozs.) it is a valuable alterative in chronic skin diseases, such as psoriasis. In the Concan the young shoots are cooked as a vegetable and given in these diseases. Dr. D. B. Master of Bombay informs us that he has seen them used with great success in psoriasis. Loureiro states that the herb is anodyne, and should be used with caution; he notices its use externally to allay pain. The

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physiological action of *solanine*, the active principle of this plant, has been investigated by Max Perles (*Centralbl. f. Klin. Med.* 1890, No. 2), who found its action upon amœboids, infusoria and ciliated epithelium cells to be that of a powerful protoplasmic poison. A solution containing less than 1 per cent. prevented the growth of bacteria; a very dilute solution added to blood accelerated coagulation, whilst a stronger solution (1 per cent.) prevented coagulation and partially dissolved the red corpuscles; left for some hours in contact with hæmoglobin it converted it into reduced hæmoglobin, but not into methæmoglobin. In cold-blooded animals solanine produced paralysis of the central nervous system, acting first on the brain and afterwards on the spinal cord, and finally paralysing the heart muscle. Locally applied solanine produced destructive changes in muscular tissue, causing paralysis and obliteration of transverse striation, while the nerves, which were at first excited, finally became paralysed.

Intravenous injections of solanine in warm-blooded animals caused violent tremblings, soon followed by clonic spasms of the muscles of the jaw, nape of the neck and back, and afterwards by paralysis of the central nervous system.

The temperature changes in poisoning by solanine were found to indicate very exactly the gravity of the case, the minimum of temperature corresponding with the maximum of danger. The dyspnœa which was observed in all the cases is attributable partly to the disturbance of the circulation and partly to the blood changes which have been already noticed.

The *post-mortem* examination of animals poisoned by solanine showed a condition similar to the enteritis of typhoid fever, with here and there hæmorrhagic extravasations into the intestinal walls. The kidneys presented lesions similar to those seen in acute nephritis, with infarction of the renal tubes.

Intra-peritoneal injections of solanine caused hæmorrhagic peritonitis with exudation.

Moderate subcutaneous injections produced little effect, but if insufficient in quantity to be poisonous, the symptoms already

described were observed, and the temperature fell as low as 31°·5 C.

The fatal dose of solanine administered by the stomach is ·30 gram. per kilo body weight; death takes place in 12 hours.

In dogs injections into the stomach cause violent vomiting, which interferes with the absorption of the poison.

Solanidine has similar properties, but is much less active than solanine; it has no local irritant action. The author classes these substances with the sapotoxins, such as quillaic acid, sapotoxin, senegin, cyclamin, &c.

Description.— *S. nigrum* is an erect annual or biennial, stem angled, with spreading or diffuse branches, one to three feet high, glabrous, or pubescent, with simple hairs, without prickles, but the angles of the stem sometimes raised and smooth or rough, with prominent tubercles; leaves petiolate, ovate-oblong, attenuated at both ends, 1 to 3 inches long, entire or repandly toothed; flowers small and white, in little cymes, contracted into umbels on a common peduncle, from very short to nearly an inch long; calyx 5-toothed or lobed to the middle; corolla deeply lobed, 3 to 4 lines in diameter; anthers very obtuse and short, opening in terminal slits, which are often continued down the sides; berry small, globular, usually nearly black, but sometimes yellow or dingy red.

S. dulcamara is a woody scandent plant, with numerous glabrous or sparingly pubescent branches, leaves ovate or oblong, subentire, lobed or lyrate, peduncles extra-axillary; cymes laxly panicled; calyx-teeth small, obtuse; corolla purple.

The berries are $\frac{1}{4}$ inch in diameter, globose, red; seeds numerous, $\frac{1}{16}$ inch in diameter, smooth. The fresh plant has a fetid odour, which it loses when dried. Taste at first bitter, afterwards sweetish.

Chemical composition.— The most important constituent of *S. nigrum* is *Solanine*, which was discovered in the berries by Desfosses in 1821. This base has been represented by various formulæ. Zwenger and Kind's analyses lead to the formula

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$C^{43}H^{71}NO^{16}$; according to Kletzinsky it is $C^{21}H^{35}NO^{7}$. A. Hilger from recent analyses assigns to it the formula $C^{42}H^{87}NO^{15}$, and to *Solanidine*, obtained from it by boiling with dilute acids, the formula $C^{26}H^{41}NO^{2}$, while Zwenger and Kind assign to solanidine the formula $C^{25}H^{41}NO$ and represent its formation as being due to the assimilation of $3OH^{2}$ by solanine, and its resolution into solanidine and 3 molecules of glücose. Solanine forms delicate colourless, silky needles, appearing under the microscope as four-sided rectangular prisms. (Zwenger and Kind; Payen and Chevallier.) It turns yellow when heated, and melts at 235° C. (Zwenger and Kind.) It is inodorous and tastes faintly bitter and somewhat acrid. (*Gmelin Handb.* xviii. 90; *Watt, Dict. of Chem.* viii. 1807.) M. E. Wotezal (1890) has published an elaborate paper on the *Distribution of Solanine and its Microchemical Reactions* in Russian, from which we extract the following :—

"Solanine was found in nine species of *Solanum* and three of *Scopolia*. In the tubers it is found chiefly in the neighbourhood of the 'eyes.' In the vegetative portions it occurs in greatest abundance in the young tissues, and in the mature tissues it is usually entirely wanting except in the neighbourhood of the buds, and of the origin of the roots. In the floral organs the reverse is the case, the quantity of solanine increasing for a time in both calyx and corolla as the flower opens, but ultimately disappearing from these organs, while it continues to increase in the green unripe fruit, diminishing again when the fruit is ripe, and being then localized chiefly in the peripheral layers. The seat of the solanine is the cell cavity, where it occurs in the form of a soluble salt, and from which also it penetrates the cell wall by diffusion.

The author regards solanine as a product neither of primary synthesis nor of disorganization, nor as a secretion or excretion, nor as a reserve substance, nor as a transporting form like asparagin, but as an intermediate stage in the series of chemical changes which the already forward plastic substances undergo in the living cell. In the flowers and unripe fruits it undoubt-

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edly also serves as a protection against consumption by animals.

Wotezal finds only three trustworthy tests for the presence of solanine, *viz.*:—(1) Mandalin's vanadin-sulphuric acid, *i.e.*, 1 part of ammonia-metavanadinate in 1000 parts of tri-hydrated sulphuric acid ($H^2SO^4+2H^2O$). The test is one of extraordinary delicacy; if the preparation contain solanine, it goes through the following series of colours:—yellow, orange-red, purple-red, brown, pure red, violet, blue-green, and then disappears altogether. (2) Brandt's reagent: 0·3 gram sodium selenate in a mixture of 8 c.c. of water and 6 c.c. of pure sulphuric acid. If the preparation containing solanine is first warmed, then, on cooling, it becomes first violet-red, then orange-red and yellow-brown, the colour finally disappearing. (3) Pure sulphuric acid as a macro-chemical reagent, but this test has no advantage over the other two. (*Pharm. Journ., July* 1890.)

Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.*, 1890, 501,) have recently reported that they have found small quantities of an alkaloid having the property of dilating the pupil in *S. nigrum*. Solanine has also been obtained from *S. dulcamara* along with a glucoside *Dulcamarin*. *Dulcamarine* was the name given by Wittstein to a nitrogenous substance which he obtained from the stalks of *S. dulcamara*. This substance has been further examined by Geissler (*Arch. Pharm.* (3) vii. 289), who, by treating it with ammonia, has freed it from a nitrogenous impurity, and by converting the remaining substance into a lead compound, and decomposing the latter with hydrogen sulphide, has obtained a pure non-azotised body having the composition $C^{22}H^{34}O^{10}$. This dulcamarin is amorphous, tastes bitter at first, afterwards persistently sweet, dissolves in alcohol and acetic ether, and is precipitated by basic lead acetate, yielding the compounds $C^{22}H^{32}PbO^{10} + 3H^2O$ and $C^{22}H^{32}PbO^{10}+5H^2O$.

By the action of dilute acids, dulcamarin is resolved into glucose and a resinous compound $C^{16}H^{25}O^6$, called *dulcamaretin*. (*Watt, Dict. of Chem.* viii. 694.)

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Toxicology.—Cases of poisoning from eating the berries of *S. dulcamara*, *S. nigrum*, and *S. tuberosum* (the potato) have occasionally been recorded in Europe, and it is also on record that the germinating tubers of the potato, have given rise to symptoms of poisoning. It would appear, however, that the process of cooking renders all those plants innocuous, or nearly so, as the herb of *S. nigrum* is used in India as a vegetable. Burton Brown (*Punjab Poisons*) records the death of three children after eating the berries of *S. nigrum*; the symptoms observed were, a feeling of sickness followed by vomiting, pain in the belly and intense thirst, pupils dilated, with impaired vision, headache, giddiness, delirium, purging and convulsions, sleep ending in coma.

Commerce.—The dried fruit of *S. dulcamara*, known as Anab-es-sálib in Bombay, comes from Persia. Value, Re. ¼ per lb.

S. nigrum is a common weed everywhere on cultivated ground. The dried fruit is met with in the shops in many parts of the country.

SOLANUM INDICUM, *Linn.*

Fig.—*Wight Ic., t.* 346; *Rheede, Hort. Mal. ii., t.* 36.

Hab.—Throughout India. The fruit and root.

Vernacular.—Bari-khatái, Birhatta, Barhanta (*Hind.*), Byakura (*Beng.*), Dorli, Mothi-ringani (*Mar.*), Ubhi-ringan (*Guz.*), Mulli, Pappara-mulli (*Tam.*), Tellamulaka (*Tel.*), Cheruchunta (*Mal.*), Gulla (*Can.*).

History, Uses, &c.—This plant is of importance in Hindu medicine as the source of one of the drugs required for the preparation of the Dasamula Kvatha. In the Nighantas it bears the Sanskrit names of Bhantaki, Vrihati, Mahati, "large egg plant," Vártáki, Mahotika, &c.; and is described as cardiacal, aphrodisiacal, astringent, carminative and resolvent; useful in asthma, cough, chronic febrile affections, colic, flatulence, worms, &c. The author of the *Makhzan-el-adwiya* notices it under

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the name of Birhatta, and repeats what the Hindu writers say about it. Chakradatta gives the following prescription as useful in bronchitis with fever: Take of the roots of *S. indicum*, *S. xanthocarpum*, *Sida cordifolia*, and *Justicia Adhatoda* one part, raisins one part, and prepare a decoction in the usual manner. Rheede notices its use in Malabar, and Ainslie (ii., 207) remarks that the root has little sensible taste or smell, but is amongst the medicines which are prescribed in cases of dysuria and ischuria in decoction to the quantity of half a teacupful twice daily. He also notices that Horsfield in his account of Java medicinal plants says, that the root taken internally, possesses strongly exciting qualities, and that Rumphius states that it is employed in difficult parturition. The berries, which are bitter, are sometimes cooked and eaten by the natives of India as a vegetable.

Description.—Trunk trifling, but the branches are numerous, ligneous, and perennial, forming a large, very ramous shrub of several feet in height, armed with numerous, very acute, somewhat recurved spines, the young parts are downy; leaves solitary, or in pairs, petioled, ovate-lobate, downy, and armed with a few straight spines on both sides, from 2 to 4 inches long; racemes between, or opposite to the leaves, supporting several long-pedicelled, middle-sized, pale blue flowers; calyx deeply 5-cleft, armed; berries erect, round, smooth, size of a marrowfat pea; while immature variegated with deeper and lighter green; when ripe, with deep orange yellow. (*Roxb.*)

Chemical composition.—200 grams of the fruits were found to consist of 58 grams of pericarps and 142 grams of seeds. These were powdered and examined separately, and had the following composition—

	Pericarps.	Seeds.
Ethereal extract	·9	13·5
Alcoholic „	5·8	10·1
Aqueous „	13·8	22·9
Mineral matter	11·2	7·7

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The pericarps contained a yellow wax-like principle melting at 45°, a trace of an alkaloid answering to solanine, and a quantity of ammonia combined as an ammonium salt. The seeds afforded 13·5 per cent. of a yellow oil having a specific gravity of ·9273. After saponification of the oil by alcoholic potash, the free fatty acids were liberated and found to consist mainly of oleic acid, and on standing in a cool place for several days, some white crystals separated out, having a melting point approximating that of myristic acid. An alkaloid was present in the seeds which could not be referred satisfactorily to solanine, and it was associated with a glucosidal principle giving a purple-coloured solution with sulphuric acid. The seeds like the pericarps contained an ammonium salt, and both portions of the fruit gave off strongly alkaline fumes on burning, and in which ammonia was easily detected. The fruits when dried and kept for some time are almost tasteless compared with their bitterness and acridity when fresh, and it would consequently appear that the alkaloids solanine and solanidine, become decomposed with the production of ammonia and other substances.

SOLANUM XANTHOCARPUM, *Schrad. et Wendl.*

Fig.—*Schrad. et Wendl. Sert. Hanov.* i. 8, *t.* 2; *Jacq. Ic. Rar.* iii., *t.* 332; *Wight Ic.*, *t.* 1401. Syn.—*S. Jacquini.*

Hab.—Throughout India. The plant.

Vernacular.—Laghu-khatâi, Bhatkatya, Bhumi-ringaní (*Hind.*), Kántakári (*Beng.*), Bhui-ringani, Kánte-ringani (*Mar.*), Patha-ringani (*Guz.*), Kandan-kattiri (*Tam.*), Vákudu, Nelamulaka (*Tel.*), Nelagulla (*Can.*), Kantam-kattiri (*Mal.*).

History, Uses, &c.—This plant is of importance in Hindu medicine, as its root is one of the *Dasamula* or "ten roots" so often prescribed in decoction by their physicians. (See *Tribulus terrestris.*) In the Nighantas it is called Kantakára and Kantakini, "thorny"; Nidigdhika, "clinging"; Vyághri, "tigress"; and Dush-pradarshani, "which cannot

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be touched" ; and is described as aperient, pungent, bitter, digestive, diuretic, alterative, astringent and anthelmintic; useful in fever, cough, asthma, flatulence, costiveness and heart disease. It is also thought to promote conception in the female. In practice the drug is generally combined with other expectorants, demulcents and aromatics.

The following prescription from the Bhavaprakasha is quoted in "Dutt's Hindu Materia Medica":—*Kantakáryavaleha*, or electuary of *S. Jacquini*. Take of Kantákári 12½ seers, water 64 seers, boil till reduced to one-fourth and strain. Boil the strained decoction till reduced to the consistence of a fluid extract, and add to it the following substances in fine powder, namely, *Tinospora cordifolia, Piper Chaba, Plumbago zeylanica, Cyperus rotundus, Rhus Kakrasingi*, long pepper, black pepper, ginger, *Alhagi maurorum, Clerodendron Siphonanthus, Vanda Roxburghii*, and Zedoary root, each 8 tolás, sugar 2½ seers, sesamum oil and clarified butter each one seer. Boil together until reduced to the proper consistence. Lastly, add honey one seer, bamboo manna and long pepper in fine powder each half a seer.

This electuary is given to allay cough. The drug is also used in decoction with long pepper and honey, and with salt and asafœtida for asthma.

Mahometan writers, under the Arabic name of Hadak, or the Persian Bádinján-i-barrí (wild egg plant), mention three kinds of Solanum, having somewhat similar properties. Their small kind, or Hejazi, appears to be the *Solanum xanthocarpum*, which they recommend in asthma, cough, dysuria, catarrhal fever, leprosy, costiveness and stone in the bladder. Under the name of *Cundunghatrievayr*, Ainslie (ii. 90) notices the use of this drug in Southern India as an expectorant. The stems, flowers, and fruit, according to Dr. Wilson (*Calcutta Med. Phys. Trans.*, Vol. II., p. 406), are bitter and carminative, and are prescribed in those forms of Ignipeditis, which are attended with a vesicular, watery eruption. Fumigations with the vapour of the burning seeds of this plant are in high repute

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in the cure of toothache; they are smoked in a *chilam* like tobacco and the natives have the idea that the smoke kills the insects which they suppose cause the pain. The ancients used the seeds of Henbane in the same way. (*Scrib. Comp.* 54.) They act as a powerful sialogogue, and thus afford relief. (*Phar. of India, p.* 181.) In the Concan 2 tolas of the juice of the fresh plant, with 2 tolas of Hemidesmus juice, are given in whey as a diuretic, and the root with chiretta and ginger is given in decoction as a febrifuge. Dr. Peters, of the Bombay Medical Service, informs us that in Bengal the plant is much used as a diuretic in dropsy.

Description.—Root at least biennial; stem none, but several flexuose, ramous branches, spreading close on the ground, for an extent of some feet, often striking root at the insertion of the leaves; angular, nearly void of pubescence; leaves frequently in pairs, oblong, pinnatifid, or laciniate, smooth, but armed on both sides with long, strong, straight spines; racemes between the leaves, and almost as long, bearing 4 to 6 alternate, pedicelled, large, bright blue flowers; calyx armed with straight spines; berries spherical, size of a large gooseberry, very smooth, drooping, while immature variegated with green and white, when ripe with different shades of yellow only.—(*Roxb.*)

Chemical composition.—The fruits of this plant were found on analysis to have a similar composition to those of the previous article, except that in this case the fruits were examined in a fresh condition, and the solanine reactions of the alkaloid and the almost entire absence of ammonia were noticed. The dried leaves left 20·74 per cent. of ash when burnt, and contained traces of an alkaloid, and an astringent organic acid giving a green precipitate with ferric salts.

S. trilobatum, *Linn., Wight Ic. t.* 854, is mentioned by Ainslie as being used medicinally in Southern India. He says:—"The root, leaves and tender shoots of this creeper, are all used in medicine by the Tamools; the two first, which are bitter, are occasionally prescribed in consumptive cases in the form of

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electuary, decoction, or powder; of the electuary a teaspoonful and a half are given twice daily." (*Mat Ind.* ii., 427.) It appears to be used as a substitute for *S. xanthocarpum.* The medicinal use of **S. verbascifolium, S. torvum** and **S. ferox** has also been recorded, and it seems probable that these Nightshades are often mistaken by ignorant people for the officinal plants.

PHYSALIS ALKEKENGI, *Linn.*

Winter Cherry (*Eng.*), Coquerét, Coquerelle (*Fr.*).

Hab.—Persia, Southern Europe. The fruit.

Vernacular.—Káknaj (*Arab., Ind. Bazars*).

History, Uses, &c.—This plant appears to be the στρύχνος ἁλικακάβος of the Greeks, which they also called φυσαλὶς or φυσαλλίς, and the Vesicaria or Halicacabus of the Romans; it was supposed to cure diseases of the bladder. It is the Kákanah of the Persians and Kákanaj of the Arabs. It also bears the names of Kachuman, and Arúsak-pas-i-pardah, or "bride behind the curtain," in Persia; the Sanskrit name is said to be Rájaputrika.

Abu Hanifeh, author of the *Book of Plants,* says of Kákanaj:—"It is of the Aghaláth and is a plant resembling the Harmal (*Peganum Harmala*), except that it is taller, with round branches, and having capsules (سنفم) like those of Harmal; it has also berries intensely red, like beads of cornelian, smaller than the Nabik (*Zizyphus Spina-Christi*) and larger than the currant, and people seek out the leaves thereof that have not been rendered foraminous, which leaves are then bruised and used beneficially as a dressing for maladies attended with pain." Other names for the fruit are Jouz-el-marj and Habb-el-lahv, which indicate that they are thought to be possessed of intoxicating properties.

Mahometan physicians describe it as diuretic, alterative and anthelmintic; and recommend it in skin diseases, rheumatism, jaundice and urinary affections. It is said to prevent con-

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ception if given to women after menstruation. Large doses are thought to be narcotic. Externally it is applied to promote the absorption of tumours, boils, carbuncles, &c. Laville's gout pills consist of 15 parts of extract of Alkekengi and 5 parts of silicate of soda. Four to ten 5-grain pills are taken daily.

Description.—The fruit is about the size, shape and colour of a small dried cherry, skin smooth and shining, reddish brown, much shrivelled; it contains a large number of flattened, reniform seeds of a light brown colour, and smaller than those of *Withania coagulans;* these are sticky from the presence of a small quantity of brown pulp, which has a fruity odour.

Chemical composition.—Dessaignes and Chautard (*N. J. Pharm.* 21, 24) found sugar and citric acid in the berries, and in the leaves and calyx an amorphous bitter principle, *Physalin,* $C^{14}H^{16}O^{5}$, which is obtained as a whitish powder on agitating the cold aqueous infusion with chloroform, and is soluble in alcohol, but sparingly so in ether, cold water and diluted acids. (*Gmelin, Handb. xvi.,* 191.)

PHYSALIS MINIMA, *Linn.*

Fig.—*Rheede Hort. Mal. x. tt.* 70, 71.

Hab.—Throughout India. The plant in fruit.

Vernacular.—Tulati-pati (*Hind.*), Káknaj (*Punj.*), Ban-tepariya, Tekári (*Beng.*), Thánmori, Chirbutli, Chirboti (*Mar.*), Kupanti (*Tel.*), Bondula (*Can.*).

History, Uses, &c.—This common weed of cultivation, called in Sanskrit *Tankári,* occurs in two forms, one with a berry about the size of a pea and the other with a berry half an inch in diameter. The former plant is pubescent and the latter glabrous. Tankári is considered by the Hindus to be tonic, diuretic and aperient, and is an ingredient in a medicinal oil which is given for enlargement of the spleen; the other ingredients are Pokharmul, Hing, Hirda, Long pepper, Bit

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(black salt), Saindhava (rock salt), Javakshara (potash), ginger and melted butter. In the Concan the plant is made into a paste with rice water, and applied to restore flaccid breasts, in accordance with the doctrine of signatures. Both varieties of this plant are noticed by Rheede, and Ainslie (ii. 15) in a note remarks that *P. minima* has been noticed by Dr. Heyne as medicinal among the Hindus, and is called by them Lakshmidevatya, "sacred to Lakshmi." Dr. Stewart states that the fruit is considered in the Punjab to be tonic, diuretic and purgative. It is used by the Mahometans as a substitute for *P. Alkekengi*.

Description.— An herbaceous annual, leaves 2 inches; petiole 1 inch; pedicels ¼ to ½ inch; calyx at flower-time ¼ to ⅙ inch; lobes lanceolate, half the length of the calyx, often hirsute, sometimes glabrescent; corolla clear yellow or sometimes spotted at the base; berry nearly globular; fruit-calyx globose in the smaller variety, 5-angular in the larger, 5 or 10-ribbed; seeds numerous, $\frac{1}{12}$ inch, discoid, reticulated, scarcely scabrous.

P. peruviana, the Cape Gooseberry, or Brazil Cherry, which is cultivated in India, hardly differs from this plant except in its larger size and more oblong berry. It affords an excellent fruit, and is now much cultivated in France and is largely used in India for making the well known "Topare jam."

CAPSICUM FRUTESCENS, *Linn.*

Fig.—*Lam. Ill.*, *t.* 116, *f.* 1; *Rheede, Hort. Mal.* ii., *t.* 54. Chillie (*Eng.*), Piment de Cayenne (*Fr.*).

Hab.—America. Cultivated throughout India. The fruit.

CAPSICUM MINIMUM, *Roxb.*

Fig.—*Wight Ic. t.* 1617; *Bentl. and Trim.*, *t.* 188. Bird's-eye Chillie (*Eng.*), Piment de l'Ile Maurice (*Fr.*).

Hab.—Uncertain. Cultivated in India. The fruit.

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Vernacular.—Mirch, Lal-mirch, Gách-mirch (*Hind.*), Mirchi, Tambari-mirchi, Mir-singha (*Mar.*), Milagay (*Tam.*), Mirapa-káya (*Tel.*), Kappal-melaka (*Mal.*), Menashina-káya (*Can.*), Lál-morich, Lanka-morich (*Beng.*), Lál-mirch, Marchu (*Guz.*).

History, Uses, &c.—Clusius states that Capsicums were brought to India from Pernambuco by the Portuguese; from India they were introduced into Germany, and finally reached England in 1595. The Spaniards were acquainted with the spice as early as 1494. Chanca, physician to the fleet of Columbus in his second voyage to the West Indies, notices them among the productions of Hispaniola as a condiment used by the natives under the name of *Agi*, which is still the common name for them in Spanish. In English they were formerly known as Guinea-pepper, and the Portuguese call them Pimenta de Guiné. Chili is the Mexican name. (*Pharmacographia.*) In the Indian vernaculars there is no special name for them, and they are not mentioned by any Sanskrit writers. Up to the present time the cultivation of the plant is carried on more extensively at Goa than at any other place in Western India, and capsicums are well known in Bombay as *Govai-mirchi*, "Goa pepper." The Arabs call the chillie Filfil-ahmar, "red pepper," in Persian it is Filfil-i-surkh, which has the same meaning. Besides the two species commonly cultivated, several varieties of *C. grossum* are met with in India as ornamental plants in gardens; they are mostly remarkable for the size of their fruit; which is almost or entirely devoid of pungency; one variety, which has been named *C. cerasiformis*, has globular fruit resembling a cherry. A yellow capsicum, having a peculiar flavour, has been introduced into India from Nipal, and from it is prepared a very highly esteemed Cayenne pepper. In India *C. minimum*, though common in many parts of the country as a weed of cultivation, is seldom used by the natives, who call it Gachh-mirch, "tree pepper," or Káfri-mirch, "negro's pepper." The Hindus and Indian Mahometans use capsicum very freely as a condiment, but the Arabs and Persians object to it. Medicinally the natives of India consider capsicum to be stomachic and stimulant, and

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a promoter of the regular action of the bowels: externally they use it as a rubefacient. The irritant properties are frequently taken advantage of to inflict torture upon prisoners and refractory children. In European medicine capsicum is used in the form of a plaster, or liniment, made with the ethereal tincture, in rheumatic and neuralgic affections; it produces warmth and redness of the part. Pads dipped in a strong infusion of the crushed pods may also be used; they should be covered with paraffin paper or oil silk, and may be kept on for several hours; as a gargle, or in the form of lozenges, it is used in tonsillitis, pharyngitis and relaxed sore-throat. In the West Indies it is used in infusion with cinnamon and sugar to relieve the sinking at the epigastrium felt by drunkards, and forms a most valuable diet drink for patient suffering from delirium tremens, as it satisfies the craving for stimulants. Large doses taken internally by persons who are not in the habit of using capsicum may produce gastro-enteritis.

Description.—The berry is very variable in size and shape, and many-seeded. The fleshy pericarp is composed of two layers, an outer consisting of thick-walled cells, and an inner, which is a soft and spongy parenchyme traversed by fibro-vascular bundles. Most of the colouring matter is contained in the outer layer, which also contains some fatty oil. The seeds are discoid, smooth or sub-scabrous; the embryo peripheric.

Chemical composition.—Thresh (*Pharm. Jour.* (3) vii. 21, 259, 473,) succeeded in isolating a well-defined highly active principle, *Capsaicin* ($C^9H^{14}O^2$), from the extract, which he obtained by exhausting the fruit of *C. minimum* with petroleum ether. From the red liquor dilute caustic lye removed capsaicin, which is precipitated in minute crystals by passing carbonic acid through the alkaline solution, and which may be purified by recrystallizing them from either alcohol, ether, benzene, glacial acetic acid, or hot bisulphide of carbon; in petroleum ether capsaicin is but very sparingly soluble, yet

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dissolves abundantly on addition of fatty oil. The latter being present in the pericarp is the cause why capsaicin can be extracted by the above process.

Capsaicin forms colourless prismatic crystals insoluble in water; it begins to volatilise at 100° C. and is powerfully irritant. The pungent taste is removed by heating with potassium bichromate and dilute sulphuric acid. $BaCl^2$ and $CaCl^2$ in alcoholic solution give a precipitate soluble in ether; $AgNO^3$ gives a precipitate soluble in ammonia, and Fe^2Cl a red precipitate when warmed.

Capsicine, an alkaloid, has also been extracted by benzene from the fruit of *C. minimum*. The benzene is evaporated and the residue dissolved in ether, from which the alkaloid is obtained by shaking with dilute H^2SO^4 (*Thresh, Pharm. Journ.* [3] vi. 941). It forms needles insoluble in water and very soluble in alcohol and ether, which may be sublimed or volatilized with steam, and are free from pungency. The hydrochloride crystallises in cubes and tetrahedra, the sulphate in prisms. (*Watt's Dict. Chem.*, 2nd Ed. i., 678.) A. Meyer has discovered that capsaicin is not, as has been generally assumed, distributed throughout the entire fruit, but only occurs in the light yellowish-red placentæ and their attachments. These parts yield 0·9 per cent. of capsaicin. According to G. Laube and H. Aldendorff capsicums contain Water 12·68, Nitrogenous substances 4·31, Volatile oil 3·05, Fat 8·17, Sugar 2·54, Nitrogen-free extractive 43·88, Cellulose 22·50, Ash 2·87 per cent., and when dried yield 0·79 nitrogen and 12·85 per cent. of volatile oil and fat. According to Warnecke, the ash of capsicums amounts to 4·66 per cent.

The colouring matter of capsicum fruits is sparingly soluble in alcohol, but readily in chloroform. After evaporation an intensely red soft mass is obtained, which is not much altered by potash, it turns first blue, then black with concentrated sulphuric acid, like many other yellow-colouring substances. By alcohol chiefly *palmitic* acid is extracted from the fruit, as shown by Thresh in 1877.

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Commerce.—Several varieties of *C. frutescens* are cultivated throughout the plains of India for local consumption which is very large, but of which statistics are not available. *C. minimum* is common as a weed of cultivation in most parts of India, but is little used by the natives. The average value of capsicums in the Bombay market is about Rs. 12 per cwt.

WITHANIA SOMNIFERA, *Dunal.*

Fig.—*Jacq. Ecl. tt.* 22,23; *Sibth. Fl. Græc.*, t. 233; *Wight I.*, *t.* 853; *Rheede, Hort. Mal. iv.*, *t.* 55. Moorenkappen (*Dutch*)

Hab.—Dry sub-tropical India, West Coast. Southern Europe. The root and leaves.

Vernacular.—Asgandh (*Hind., Guz.*), Asvagandhá (*Beng.*), Asvagandhá, Tula, Dorgunj, Kanchuki (*Mar.*), Amkúláng-kálang (*Tam.*), Pénérrú-gadda (*Tel.*), Hirimaddina (*Can.*).

History, Uses, &c.—This plant bears the Sanskrit names of Asvagandha, Turagi or Turangi, and Turagi-gandha, "smelling like a horse or mare"; Varáha-karni, "boar-eared"; Vrisha, "amorous," &c. It is described in the Nighantas as tonic, alterative, pungent, astringent, hot and aphrodisiac, and is recommended in rheumatism, cough, dropsy, consumption and senile debility. Chakradatta recommends it in decoction with long pepper, butter and honey in consumption and scrofula. A *ghrita* or medicinal butter prepared by boiling together one part of the root with one part of clarified butter and ten of milk may be used in such cases. As an aphrodisiac and as a remedy for rheumatism the drug is usually combined with a number of aromatics, each dose contains about 30 grains of the root. It is also made into a paste with aromatics for local application in rheumatism. Indian Mahometan writers merely repeat what the Hindus say about this drug, and do not recognise in it the Kaknaj-el-manoum of the Arabs, which is supposed to represent the στρυχνος ὑπνωτικος of the Greeks, the description of which by Theophrastus agrees

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tolerably well with *W. somnifera.* Rheede calls it Pevetti, and states that a vulnerary ointment is prepared from the leaves. Prosper Alpinus (i., cap. 33) describes and figures it under the name of *Solanum somniferum antiquorum.* Roxburgh states that the Telinga physicians reckon the roots alexipharmic. Ainslie (ii. 14) says:—"The root as found in the medicine bazars, is of a pale colour, and in external appearance not unlike our gentian; but it has little sensible taste or smell, though the Tamool Vytians suppose it to have deobstruent and diuretic qualities, given in decoction to the quantity of about half a teacupful twice daily; the leaves moistened with a little warm castor oil, are a useful external application in cases of carbuncle." The authors of the *Bombay Flora* say that the seeds are employed to coagulate milk like those of *W. coagulans.* We have tried the experiment and find them to have some coagulating power.

The plant is very common along the shores of the Mediterranean, where it has always been reputed to be hypnotic. The properties of *W. somnifera* have recently been investigated by Dr. Trebut with regard to its reputation for hypnotic properties; he states that he has obtained an alkaloid from it which has hypnotic action and does not produce mydriasis. P. L. Simmonds (*Amer. Journ. Pharm.*, Feb., 1891) states that the plant is employed at the Civil Hospital, Alger, as a sedative and hypnotic.

Description.—The plant has a long tapering light brown root, which may attain the size of a carrot; it is surmounted by a knotty crown, from which spring several shrubby, flexuose round branches, 1 to 5 feet in length. The leaves are double, ovate, entire, 2 to 4 inches long; flowers axillary, subsessile, crowded at the ends of the branches; corolla campanulate, yellowish green, very small; berry red, smooth, size of a pea, covered by a membranaceous closely-fitting calyx, open at the apex; seeds numerous, yellowish white, reniform, laterally compressed, about $\frac{1}{16}$th of an inch long; testa honeycombed. The whole plant is covered with small branched and pointed

white hairs, which give it a hoary appearance. The odour is pungent and disagreeable like horse's urine.

The dried root as it appears in commerce is of very uniform appearance, being from 4 to 8 inches long, and from ¼ to ½ an inch in diameter at the thickest portion a little below the crown; it is plump, smooth, tapering, and of a light yellowish brown colour externally, white internally, brittle; fracture short and starchy. The root is seldom branched. Attached to the crown are the remains of several slender stems. Microscopic examination shows the substance of the root to be principally composed of starch, enclosed in delicate oval cells; the cortical portion is about $\frac{1}{20}$ inch in thickness. The vascular system consists of a large central bundle of scalariform and dotted vessels; round this several smaller bundles and single vessels are arranged in a radiating manner. It has a mucilaginous and slightly bitter taste. In the "*Materia Medica of Western India*" an opinion is expressed that the commercial article cannot be the root of *W. somnifera*. This opinion was founded upon a comparison of the drug with the root of that plant as found in the salt marshes near Bombay, where it acquires a twisted, woody form, entirely different to the tapering, starchy root which it has when growing in sweet soil. Young roots obtained from Satara exactly corresponded with the drug of commerce. Another point of difference is the red colour of the inner bark in the Bombay roots, which was not observed in those from the Deccan. The foliage, flowers and fruit of both plants appear to be identical.

Chemical composition.—Dr. Trebut in 1886 separated an alkaloid from the Mediterranean plant, which forms a crystalline sulphate having hypnotic action, but not producing mydriasis. He provisionally named the alkaloid *Somniferine.* (*Lancet.*) The root bark of the Indian plant, reduced to fine powder and exhausted with alcohol, afforded a deep red-coloured tincture which left a brittle red extract when evaporated to dryness. The extract yielded to acidulated water an alkaloid giving precipitates with the ordinary reagents as well as the alkalies. The alkaloid

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was left as an amorphous substance from its solution in ether, but gave crystals when neutralized with sulphuric or hydrochloric acid. It had a bitter taste, was not coloured with nitric acid, but with sulphuric acid and alcohol it imparted a red colour similar to that produced by solanine. A solution of the neutral acetate of the alkaloid was found to have no action upon the eye. A fatty and colouring matter were also present in the root; the latter was resinoid, and the alkaloid was combined with an astringent acid. The leaves afforded 19·5 per cent. of ash, and a trace of alkaloid was detected in them.

Toxicology.—Dr. Burton Brown (*Punjab Poisons*) records a fatal case of poisoning by the seeds of this plant. The symptoms observed were vomiting, insensibility, convulsions; the patient became unconscious with dilated pupils insensible to light; there were continued tetanic spasms of the muscles of the face and extremities, tongue not bitten, no lockjaw, face and lips livid, veins distended.

WITHANIA COAGULANS, *Dunal.*

Fig.—*Wight Ic.*, *t.* 1616; *Stocks in Hook. Ic.*, *t.* 801.

Hab.—Punjab, Sind, Afghanistan. The fruit.

Vernacular.—Panirband, Panir-ja-fota (*Sind.*), Khamjaria (*Punjab*), Spin-bajja (*Afghan.*), Akri (*Hind.*), Kakanaj (*Bomb.*).

History, Uses, &c.—A small, rigid, grey undershrub, the fruit of which is commonly used in Sind, N.-W. India and Afghanistan to coagulate milk instead of rennet; the natives of those countries rub up a few of the fruits with a small quantity of milk and add this to the milk to be coagulated. This useful plant appears to have attracted little notice until 1849, when it was described by Dr. Stocks (*Journ. Bomb. Asiat. Soc.*, 1849, p. 55). The fruit is also used as an emetic, and smaller doses as a remedy for dyspepsia arising from chronic liver disease; it is alterative and diuretic. In Bombay it is usually confounded

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with the fruit of *Physalis Alkekengi*, Wild., imported from Persia, the Hab-el-káknaj or Káknaj of the Arabians, which is described by Ibn Sina as an alterative similar to Dulcamara, and especially useful in skin diseases. The berries of both plants have a reputation as blood purifiers. Recently, from experiments made by Sir J. D. Hooker at Kew, it has been ascertained that 1 oz. of the fruit of *Withania coagulans* and 1 quart of boiling water make a decoction, one tablespoonful of which will coagulate a gallon of warm milk in about half an hour. Experiments of a similar nature have been made on the Kilkerran Estate, the property of Sir James Fergusson, late Governor of Bombay, four ounces of the fruit were allowed to simmer for 12 hours in $1\frac{1}{2}$ pint of water, and half the liquid was then added to 55 gallons of milk; the milk curdled in an hour and a half, affording a firm curd free from taste and smell; of this a cheese was made which proved to be excellent.

Description.—The entire fruit is about $\frac{3}{8}$ of an inch in diameter, flattened at the base, and enclosed in a leathery close-fitting calyx, with a small 5-partite opening at the apex, through which a small portion of the fruit is visible; this is red when fresh, but yellowish and chaffy when dry; within is a mass of flattened reniform seeds nearly $\frac{1}{8}$ of an inch in their longest diameter, and held together by a viscid brown pulp which has a nauseous fruity odour.

Chemical composition.—The following is Mr. Sheridan Lea's report upon the "rennet" ferment contained in the seeds:—

"Taking equal weights of the seeds, I extracted them for 24 hours with equal volumes of (1) water, (2) 5 per cent. sodic chloride, (3) 2 per cent. hydrochloric acid, (4) 3 per cent. sodic carbonate. Equal volumes of each of the above were added in an acid, alkaline, and neutral condition, to equal volumes of milk, and heated in a water-bath at 38° C. The milk was rapidly coagulated by the salt and sodic carbonate extracts, much less rapidly by the other two; of the four, the salt extract was far the most rapid in its action. All subsequent experiments have

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shown that a 5 per cent. solution of sodic chloride is the most efficient in the extraction of the active principle from the seeds.

There is no doubt that the substance which possesses the coagulating power is a ferment closely resembling animal rennet.

I.—A portion of the 5 per cent. sodic chloride extract loses its activity if boiled for a minute or two.

II.—The active principle is soluble in glycerine, and can be extracted from the seeds by this means; the extract possesses strong coagulating powers even in small amounts.

III.—Alcohol precipitates the ferment body from its solutions; and the precipitate, after washing with alcohol, may be dissolved again without having lost its coagulating powers.

IV.—The active principle of the seeds will cause the coagulation of milk when present in very small quantities, the addition of more of the ferment simply increasing the rapidity of the change.

V.—The coagulation is not due to the formation of acid by the ferment. If some of the active extract be made neutral or alkaline, and added to neutral milk, a normal clot is formed, and the reaction of the clot remains neutral or faintly alkaline.

VI.—The clot formed by the action of the ferment is a true clot, resembling in appearance and properties that formed by animal rennet, and it is not a mere precipitate.

The question of preparing an extract which should be capable of being kept for a considerable time is perhaps of importance. Ordinary commercial rennet usually contains a large amount of sodic chloride and some alcohol. One specimen I analysed contained 19 per cent. of common salt, and 4 per cent. of alcohol. I have, therefore, added to the 5 per cent. chloride extract mentioned above enough salt to raise the percentage of this to 15 per cent., and also alcohol up to 4 per cent. The activity of the extract is not appreciably altered by this, and

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such a preparation corresponds very closely in activity with a commercial solution of animal rennet with which I compared it. The possibility of making extracts which may be expected to keep, is thus indicated, but, of course, time alone will show whether the activity of the ferment is impaired to any important extent by such keeping.

I may add, in conclusion, that I have coagulated a considerable volume of milk with an extract such as I have described, and prepared a cheese from the curds. I have also given a portion of the extract to a professional cheese-maker, who has used it as a substitute for animal rennet in the preparation of a cheese. The product thus obtained, and the statements of the person who has made the experiment for me, lead me to suppose that extracts of the seeds of Withania can be used as an adequate and successful substitute for animal rennet." (*Pharm. Journ.* [3] xiv. 606.)

An attempt has been made by Mr. D. S. Kemp, of Bombay, to preserve the ferment by means of sugar, but with only partial success.

ATROPA BELLADONNA, *Linn.*

Fig.—*Eng. Bot. t.* 934; *Bentl. and Trim. t.* 198. Common Dwale, Deadly Nightshade (*Eng.*), Belladone, Morelle furieuse (*Fr.*).

Hab.—Western Himalaya, Persia, Europe. The root and herb.

Vernacular.—Suchi (*Hind.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit medical writers, and does not appear to have been ever used medicinally in India. It appears to correspond pretty well with the στρύχνος μανικος of the Greeks, though it cannot with certainty be identified. The Arabian writers simply copy from the Greeks their account of the different kinds of strychnos and describe them as varieties of Inab-eth-thálib, a

general name in Arabic for the Nightshades. Háji Zein-el-Attar (A. D. 1368), speaking of Inab-eth-thálib, in Persian Rubah-turbak and Sag-angur, "foxes' or dogs' grapes," concludes by cautioning his readers against the use of a kind with black berries, which causes delirium and is highly poisonous. In cases of poisoning by the latter plant he directs emetics to be given, and milk or honey and water, with aniseed and bitter almonds, to be administered.

The use of Belladonna as a medicine is of quite recent date; it was only known to the ancients as a noxious herb. Its action upon the pupil of the eye appears to have been utilized in the 16th century by the Italian ladies, whence the name Herba Belladonna. (*Matth. Comment.* (1558) 533.)

Physiological action.—All animals are not equally affected by this poison. It has been observed that rabbits can feed upon the plant with impunity, and that the pupils of their eyes may be dilated by the application of their own urine. Birds eat the fruit, and, strange to say, the drug has no local action upon their eyes. Hecquet has observed the insusceptibility of marsupials to the poisonous action of belladonna, and snails and slugs feed upon its leaves with impunity. Atropine has no injurious effect when injected into the blood vessels of birds and herbiverous animals, it is therefore evident that their nervous system is not susceptible to its toxic action.

The carnivora, under the influence of the drug, exhibit along with dilated pupils, evidences of suffering, retching or vomiting, general muscular debility, dulness of the senses, and increased frequency and force of the heart's action, but no delirious excitement is observed. (*Acad. des Sciences, Séance du* 28 *Juin*, 1875.)

In man when poisonous doses of belladonna have been taken, a sense of tightness or pain is felt in the forehead and eyes, with giddiness, confusion of thought, and noises in the ears. The sight is confused, objects are hazy or their character is mistaken. Often they appear to be much smaller than natural. Spectral illusions, generally of a pleasing character,

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are frequent, such as jewels, flashes of coloured light, birds of brilliant plumage, and insects with enamelled wings. In other cases they have the hideous appearance of the phantasms of delirium tremens. Sometimes there is a total blindness of several days' duration, and even after all mental disorder has subsided. The mind is apt to be filled with extravagant ideas; there is often delirium, which is generally of a gay description, and which prevents sleep or disturbs it with fantastic dreams. Sometimes the patient is quite conscious of his illusion and delirium, but is without the power to control either of them. The latter may be characterized by the incessant repetition for hours of some habitual act or phrase; sometimes though rarely, it is violent, maniacal, and attended with injury to himself or the attendants; but, in general, poisonous doses of the drug give rise to active and, for the most part, joyous delirium. It is a powerful anæsthetic; in cases of poisoning by it ending in recovery there has been almost a total loss of sensibility of the skin, lasting for several days. It has no direct soporific operation. Belladonna in excessive dose renders the gait unsteady and staggering, producing numbness with trembling and jerking movements of the limbs; the patient unconsciously runs against objects in his way, or avoids encountering imaginary ones; he is unable to co-ordinate his movements or to pick up small objects. The pupil is dilated, the eyes bright, the voice husky, or deglutition, owing to dryness of the throat, is impossible; the bladder is paralyzed and the urine retained, or both this secretion and the fœces may be passed involuntarily. The upper eyelid is apt to be paralyzed, and may remain so for months. (*Stillé and Maisch.*)

Symptoms exactly similar to these have frequently been recorded in cases of datura-poisoning in India. The action of belladonna on the brain has been attributed to a deficiency of blood in that organ caused by stimulation of the vaso-motor nerves, but as ligature of the carotids is not followed by any of the peculiar symptoms produced by belladonna, this explanation does not appear to be reasonable. The drug appears to exert some special action on the brain which is not understood.

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The action of belladonna on the spinal cord also has not been satisfactorily explained. The spinal symptoms observed after poisonous doses, *viz.*, suspension of mental control over movements and their co-ordination, seem to result from impaired sensibility and power of motion. Gubler, two hours after the subcutaneous injection of several milligrams of sulphate of atropine, observed symptoms of paralysis of both motor and sensory nerves, the patient being unable to button his clothes from want of power and feeling in the fingers. (*Gubler, Dict. Encyclop. des Sci. Med.* (1) *t.* vii. *et* ix.)

Like all other medicines which act directly through the nervous system, small and large doses of belladonna produce opposite effects, the former stimulating, the latter paralyzing it. The direct action of small doses upon the heart is to increase the vigour and the frequency of its contractions; but large doses render the pulse still more frequent, but more and more feeble and thready.

Under the action of full doses of belladonna the pulsè is at first slower and fuller, contrary to what takes place in the lower animals after the subcutaneous injection of atropine, but afterward becomes more frequent, as well as more feeble, until in fatal cases it grows thready and intermittent. During the active period of the operation the whole capillary circulation would seem to be congested, for the external mucous membranes are dry, the face is red and turgid, there is a sense of fulness in the head, with throbbing of the arteries, as if the blood were prevented from returning to the heart by a ligature around the neck. But the intracranial pressure does not appear to be increased in a like proportion. (*Jacobi.*) The general dryness of the skin and throat and larynx contrasts with the greatly augmented secretion of the kidneys during the active stage of belladonna-poisoning. This diuresis has been attributed to the fact that the active principle of the drug is excreted with the urine, and almost exclusively in this manner. Irritation of the scrotum sometimes exists in a high degree. (*Stillé and Maisch.*)

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Amongst the most remarkable and earliest indications of the action of belladonna is dilatation of the pupil, and loss of the power of accommodation, the degree and persistence of these symptoms being in proportion to the dose employed. The defects of vision produced by the drug are various, there may be want of defining power, diplopia, presbyopia, want of the power of accommodation or even amaurotic amblyopia. Some of these defects may even persist when the natural diameter of the pupil has been restored by eserine or has gradually recovered its normal condition, which indicates that the retina itself has lost some of its sensibility. The manner in which the drug acts upon the pupil has been much discussed by physiologists; Gubler, who has thoroughly investigated this question, admits that the various theories which have been suggested, *viz.*—paralysis of the iris, excitation of its radial fibres, paralysis of the ciliary nerves or their spinal centres, contraction of the blood vessels of the veins, torpidity of the ophthalmic branch of the trigeminal and of the retina—are individually insufficient to explain the physiological fact. He considers it to be of a complex nature, and that several of the causes above mentioned contribute to its production. The solution of the problem becomes more difficult when we consider the resistance of the iris of birds to the action of the drug. Rossbach and Frölich have observed that in rabbits and frogs the pupil contracts before dilating. (*Gubler, loc. cit.*)

Belladonna is antagonistic in certain respects to eserine, opium, ergotine and pilocarpine, *viz.*, with eserine and ergotine as regards its action on the pupil, with pilocarpine as regards its action on the secretions of the skin, and with opium as regards its action on the brain. Its antagonism to opium is of most importance, as numerous cases are on record in which atropism has been controlled by morphia; on the other hand, the narcotism of opium has equally been arrested by atropine.

The medicinal applications of the drug are numerous. As a sedative it is prescribed in neuralgia, colic, gastralgia, constipation, nocturnal incontinence, and photophobia. As an antispasmodic it is useful in tetanus, cramps, and painful

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contraction of the involuntary muscles; as a mydriatic in pupillary stenosis, cataract, iritis, posterior synechia, and during the operation for, and after treatment of cataract. In convulsive disorders it has been used with small success in epilepsy, chorea and eclampsia. To control secretions it is used in excessive perspiration, profuse salivation, copious catarrhal defluxions and to arrest the secretion of milk. As a preventive against scarlatina it is supposed by some to act by rendering the condition of the mucous membranes less favourable to the absorption of the poison.

As an antidote it is used in poisoning by opium, eserine and muscarine.

Description.—An herbaceous plant with thick, smooth stems, 4 to 5 feet in height; leaves 3 to 6 inches long, stalked, broadly ovate, acuminate, attenuated at the base, pubescent when young; flowers solitary, campanulate, pendulous, purplish-green; berries black, large and shining. The fresh plant has a fetid odour and a nauseous faintly bitter taste. The berries are sweet. The root is large, fleshy, tapering and branched, 1 to 2 inches thick, and a foot or more in length, it has a thick, light brown bark, and is internally of a dirty white colour. Odour not peculiar; taste acrid.

Chemical composition.—All parts of the plant contain *atropine* together with *hyoscyamine.* Atropine, $C^{17}H^{23}NO^{3}$, crystallizes in needles from dilute alcohol; it is slightly soluble in water, and very soluble in alcohol or chloroform, and the solutions are alkaline and taste bitter. Its salts enlarge the pupil of the eye. Atropine is decomposed by hot baryta water or cold concentrated HCl into tropic acid, $C^{9}H^{10}O^{3}$, and tropine, $C^{8}H^{15}NO$. Crystalline tropine tropate has no action on the eyes, but when treated with dehydrating agents, such as Zn Cl^{2}, or HCl, atropine is formed. Tropine, according to Ladenburg, is a substituted tetrahydropyridine containing the methyl (CH^{3}) and the oxethyl ($C^{2}H^{4}OH$) groups in place of two H atoms, and tropic acid is a phenyloxypropionic acid. By combining with tropine other aromatic acids we obtain tropeïns, a class of compounds analogous in constitution to atropine. One of

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these a compound of tropine with one of two isomeric phenyl-glycollic acids has been named homatropine, and has proved physiologically important. Atropine is the same as daturine, the active principle of the Daturas; it occurs along with hyoscyamine in those plants and also in Duboisia and probably in other Solanaceous plants. *Belladonnine* is an alkaloid occurring in the mother-liquor from which sulphate of atropine has been crystallised; it is amorphous, very slightly soluble in water, very soluble in alcohol, ether and chloroform. It is but slightly attacked by boiling baryta water, but is split up by alkalies into tropic acid and oxy-tropine, $C^8H^{15}NO^2$. This would indicate that belladonnine is oxy-atropine, $C^{17}H^{23}NO^4$. According to Merling belladonnine is $C^{17}H^{21}NO^2$, and gives tropine, atropic acid, and iso-atropic acid when boiled with baryta-water. For further information on the chemistry of atropine and its decomposition products, the reader is referred to *Watt's Dict. of Chem., 2nd Ed.*; *Stillé and Maisch, National Dispensatory, 4th Ed.*; *Liebig's Annalen*; *Berichte der deutsch. Chem. Ges.* *Atropamine* is a new alkaloid found by Hesse in Belladonna root, where it is occasionally present in considerable quantity. It is amorphous, melts at 60° C., is easily soluble in alcohol, ether and chloroform, has the formula $C^{17}H^{21}NO^2$ (differing from atropine, that is, hyoscyamine and hyoscine, by containing one H^2O less; but identical with pure belladonnine). It differs from the other belladonna alkaloids by forming beautifully crystallized haloid salts; it is optically inactive; the hydrochlorate in 2 per cent. solution is not mydriatic. Atropamine is only decomposed by prolonged boiling with alcoholic baryta solution, yielding tropine and an unknown acid, which may under some conditions re-arrange its atoms to form cinnamic or isocinnamic acid. Mineral acids easily bring about the decomposition, but first convert the atropamine into belladonnine; this easy decomposition may explain why the alkaloid was not sooner discovered as it is easily isolated. It is precipitated from its salts by ammonia, potash and soda as oily drops. (*Pharm. Ztg.* 1890, 471; *Amer. Journn. Pharm.* Sept. 1890.)

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Mr. A. W. Gerrard has obtained the following amount of alkaloid from Belladonna roots and leaves from plants of different ages:—

Age.	Wild. Yield from root.	Yield from leaves.
2 years	·260	·431
3 „	·381	·407
4 „	·410	·510
	Cultivated.	
2 years	·207	·320
3 „	·370	·457
4 „	·313	·491

Prof. Schmidt. and Mr. Schütte (*Apoth. Ztg.* 1890, 511) have obtained the following alkaloidal results from Belladonna roots:—

Taken in	Old roots.	Young roots.
	Per cent.	Per cent.
Spring	0·174	0·127
Summer	0·358	0·452
Autumn	0·280	0·458

They found that the young roots contained only hyoscyamine, and the old roots much hyoscyamine and a little atropine; no difference was observed between roots collected in spring, summer or autumn.

Toxicology.—Cases of fatal poisoning by belladonna are few in number. A lad of sixteen died from a drachm of the extract, and a woman of sixty-six after swallowing "a tea-spoonful of belladonna liniment." A woman, having taken ½ ounce each of Lin. belladonnæ and Lin. aconiti (*Br. Phar.*), died in spasms within half an hour. (*Edinb. Med. Jour.*, xxvii. 443.) A man having liquefied an ointment containing 2½ drachms (gm. 10) of extract of belladonna, injected it into his bowel. He voided a portion of it, but the remainder caused the

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most marked symptoms of belladonna-poisoning. Recovery ensued without special treatment. (*Bull. de therap.* ci. 239.) Children have a remarkable tolerance of belladonna. After death by belladonna or atropine the lungs and right side of the heart are engorged, the brain and meninges are congested, and the retina is hyperæmic, and a corresponding condition of the spinal cord has been observed. (*Stillé and Maisch.*)

No cases of criminal poisoning by Belladonna have been recorded in India, but poisoning by Datura is extremely frequent (see *Datura*). Dr. Warden (*Ind. Med. Gaz.* 1879,) records a non-fatal case of poisoning ensuing upon the hypodermic injection of 5 to 6 drops of Liq. Atrop. Sulph., B. P. Immediately after the injection the medical officer in charge of the case states that he scarified the part, and pressed out as much of the injected fluid as possible. Within five minutes after the injection, the patient complained of vertigo, was unable to sit in a chair, and had to be carried to a bed. Within an hour after the injection the patient was delirious, the symptoms appeared to occur in paroxysms. The pupils were much dilated. Three hours after the injection the patient was quieter, save for an attack of furious delirium. Micturition was increased; the pulse between 130—140 and rather weak. Six hours after the injection, the patient was picking up imaginary objects, tying up imaginary rupees in his clothes, spinning, and carrying his fingers along imaginary threads; at times he would dig at the ground with his fingers and look for his shoes, all the while talking incessantly. 10½ hours after the injection the symptoms had considerably abated, and during the night sleep was disturbed by wild dreams. On the following morning the patient stated that he had very little recollection of the events of the preceding day. Assuming 5 drops to have been injected, the amount would be equivalent to ·0418 of a grain of the sulphate.

Dr. E. Lawrie of Hyderabad, Deccan (*Medical Record*, 1890,) has recorded a case of accidental poisoning by atropine, in which 4 grains were taken in mistake for antipyrin, the patient soon became unconscious, and although the contents of the

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stomach had been removed, and all approved methods for restoration tried, his condition appeared hopeless, when Dr. Lawrie injected one grain of morphia subcutaneously, and maintained artificial respiration, a second grain of morphia was injected, and after 7 hours a third grain. One hour after the last injection the patient was restored to consciousness.

MANDRAGORA OFFICINARUM, *Linn.*

Fig.—*Bulliard Herb., t.* 145. Mandrake (*Eng.*), Mandragore (*Fr.*).

Hab.—Levant. The root.

Vernacular.—Yebruj (*Ind. Bazars*), Lakshamana (*Hind.*), Kattai-jati (*Tam.*).

History, Uses, &c.—In the Nighantas the root of this plant bears the names of Lakshamana, "possessed of lucky signs or marks"; Putra-da, "child giver"; Rakta-vindu, "a drop of blood"; and Bhágini, "co-heiress." It is described as a promoter of conception, aphrodisiac, and a corrective of the condition known as *tri-dosha,* or a disorder of the three humors of the body: bile, blood and phlegm. The Hindus appear to have derived their knowledge of the drug from Western nations, or possibly from the Chinese, as the only Indian species of Mandragora, *M. caulescens,* Clarke, is not known to be used medicinally. From the time of Hippocrates to the first century of the Roman Empire, mandragora was used medicinally by the Greek physicians, sometimes as an anæsthetic before surgical operations, but more frequently as an application to painful tumours. The root bark was preferred as being the most active part, but the leaves were also used, more especially for local application. Internally the juice of the root was usually administered in wine or vinegar. The description of the action of mandragora juice given by Dioscorides and Pliny leave no doubt of its resemblance to that of belladonna. Theophrastus and Dioscorides mention that the plant was also used in love

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philtres, which appears to be explained by the sensual excitement and hallucinations that are observed in datura poisoning. Like many other medicinal plants Mandrake appears always to have been collected with certain superstitious ceremonies; it was supposed that it could only be drawn from the ground without danger to the collector by the assistance of a dog, who, after the earth round the root had been removed, was tied to it by the neck and beaten until his struggles effected its extraction, and not unfrequently the death of the animal. The ancients speak of two kinds of Mandragora, male and female, the former has been identified as *M. vernalis*, Berth.; it has larger leaves and fruit than *M. officinarum*. From the time of Theophrastus up to the fifth century of our era the superstitions which have surrounded the mandrake appear to have gradually multiplied: we then find it spoken of as *anthropomorphon* and *semi-homo*, and described as having a human form and wonderful fertilizing powers. In the Middle Ages it became a mystical magic root, which existed only in fancy, and was represented by a fictitious image in the form of a man or woman manufactured from some other root, and used by priests and charlatans as a charm. It is the *Alrúna* of German mythology, which was believed to be a gallow's mannikin sprung from the seed of men who were hanged; that when pulled out of the earth by a black dog it shrieked like a child.* It came to be regarded as a kind of talisman or fetish which could bring good fortune to its possessor. In France it was known as Mandagloire or Maglore (main de gloire), and was regarded as a kind of fairy which if well treated would bring good luck to its owner.

Chéruel (*Dict. Hist. des mœurs et coutumes de la France*) gives the following extract from an anonymous diary of the 15th century:—"En ce temps, frère Richard, cordelier, fit ardre plusieurs *madagfoires* (mandragores) que maintes sottes gens gardoient et avoient si grant foi en cette ordure, que pour vrai ils croyoient fermement que, tant comme ils l'avoient, pourvu qu'il fut en beaux drapeaux de soie ou de lin enveloppé, jamais ils ne seroient

* De Gubernatis states that near Chieti, in the Abruzzes, it is still extracted from the ground in this manner.

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pauvres." This superstition, says Chéruel, was still current in the 18th century among the peasantry of France. Dr. Pereira mentions his having seen a rude representation of a human figure fashioned out of the root of *Bryonia dioica*, exhibited at an herb-shop in England as a Mandrake. The Arabs call the mandrake *Luffah*, a name which they also apply to a kind of melon known in Syria as Shammám and in Persia as Dastambuyeh, "perfuming the hands," the *Eucumis Dudaim* of Linnæus, and supposed to be the Dudaim or "love apple" of Gen. xxx. 14. In Persia the mandrake is known as Mardumgyah and Sagshikan. Mahometan medical writers, under the name of Yebruj, Yebruh or Yebruj-el-sanam, reproduce with slight modifications the European myths concerning the plant. Haji Zein-el-Attar states that on the borders of the Garmasir of Shiraz, near the fort of Shahryari, mandrake root was in his time (A.D. 1368) collected with the assistance of dogs, and was known as Sagkand (*Sag*, "a dog," and *kandan*, "to dig"). In cases of poisoning by it he recommends emetics and the administration of aromatics in milk, and concludes by saying that it is beyond the province of medicine to discuss its use as a love-philtre. Mandrake roots, though not well-known in India, are occasionally offered for sale as a charm; the narcotic properties of the plant do not appear to be known to the natives. In China the plant is said to be much used as an anæsthetic, and in Europe the leaves are still sometimes used as as a local application to tumours. Guibourt says:—"Les feuilles fort partie du baume tranquille (Élæolé de solanées composé).

Description.—Mandragora is a perennial plant, with a long, thick, fusiform, light brown root, which often bifurcates; the leaves are all radical, petioled and humifuse, broad, acute, with undulating edges; flowers numerous, on peduncles shorter than the leaves; fruit a yellow berry, which in *M. vernalis* (male mandrake) is round and the size of a crab-apple, whilst in *M. officinarum* (female mandrake) it is ovoid and rather smaller. The leaves of the latter plant are also narrower and smaller than those of the so-called male mandrake. The plants when fresh have a nauseous acrid odour.

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Chemical composition.—Herr Ahrens reports that he has separated two basic substances that are probably isomers of hyoscyamine (*Annalen*, ccli., 312.) The residue from the evaporation of an alcoholic extract of the roots was treated with acidulated water, the solution treated with potassium carbonate in excess and then shaken with ether and the ether evaporated, when a deliquescent alkaloidal substance was left, which when dried over sulphuric acid resembled a brittle resin. When neutralized with sulphuric acid it formed a sulphate crystallizing in white scales, a solution of which dropped into the eye dilated the pupil. Analysis of the gold salt gave results pointing to the formula $C^{17}H^{23}NO^{3}$,HCl, AuCl, or the same as that of hyoscyamine, atropine and hyoscine. But although the gold salt had much of the external appearance of hyoscyamine gold salt, and a melting point only six or eight degrees lower, the properties of the other salts studied differed widely from the corresponding salts of hyoscyamine, and moreover the new substance was not converted into atropine by prolonged contact with alkaline liquor. Herr Ahrens is therefore convinced that the substance is a new isomer of the belladonna alkaloids and has named it "*mandragorine.*" The press residue left after the extraction with alcohol was then treated with acidulated water and the aqueous solution supersaturated with potassium carbonate was shaken with ether, which left on evaporation an oily base that did not crystallize over sulphuric acid. A solution of the sulphate of this substance, which could not be obtained crystalline, when applied to the eye also dilated the pupil. The mercuric chloride, platinochloride and gold double salts were obtained crystalline; but the quantity available was too small to allow of the determination of its composition, although Herr Ahrens thinks it is probably another isomer of the belladonna alkaloid. (*Pharm. Jour. June 8th,* 1889.)

DATURA STRAMONIUM, *Linn*

Fig.—*Eng. Bot., t.* 935; *Bentl. and Trim., t.* 192. Thorn apple (*Eng.*), Pomme épineuse, Herbe aux sorciers (*Fr.*).

Hab.—Temperate Himalaya, Afghanistan, Persia.

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DATURA FASTUOSA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1396; *Rheede Hort. Mal. ii.*, *t.* 28.

Hab.—Throughout India.

DATURA METEL, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1440; *Rumph. Herb. Amb. v.*, *t.* 243.

Hab.—W. Himalaya, W. Deccan Peninsula. The roots, leaves and seeds.

Vernacular.—Dhatúra (*Hind.*), Dhútúra (*Beng.*), Dhatúro (*Guz.*), Umattai (*Tam*), Ummetta (*Tel.*), Ummatta (*Mal.*), Ummatté (*Can.*), Dhotara, Kánte-dhotara, Pisola (*Mar.*).

History, Uses, &c.—The Sanskrit names Dhustura or Dhattura, and Unmatta, "insane," include all the species and varieties of the plant, and are the source from which the vernacular names are derived. We know of no aboriginal name for the plant, and consequently infer that it was introduced into India at the time of the Arian invasion. The Marathi name Pisola appears to be derived from the Sanskrit पिस, to hurt or injure. Sanskrit writers sometimes specify whether black or white Dhustura is to be used, but do not draw any distinction between the properties of the different plants. In modern native practise the black or purple-flowered variety of *D. fastuosa* is preferred. In the Nighantas Dhustura bears numerous synonyms, such as Dhúrta, "rogue"; Kitava, "crazy"; Mátula, "maternal uncle"; Tarala, "libidinous," &c. It is described as intoxicating, digestive, emetic and heating; useful in fever, skin diseases, boils, itch, worms, insanity, &c. Hindu physicians frequently prescribe the drug in fever attended with catarrhal symptoms, but combine it with so many other remedies that it is difficult to judge how much of the effect produced is due to the Datura. The *Svalpajvarúnkusa* may be taken as a specimen of this kind of prescription; it contains mercury, sulphur, aconite, ginger and long and black peppers, of each one part, to two parts of Datura seeds. The dose is 4 grains

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of the mass, which is directed to be made with the assistance of lemon juice.

As a local application to inflamed and painful parts, the pounded leaves mixed with turmeric in the form of a paste are much used as a domestic remedy. Similar pastes are made with the fruit and juice, with or without opium, and mixed with oil; they are used to destroy lice and in parasitic skin diseases.

A pill made of the pounded seeds is placed in decayed teeth to relieve toothache, and the leaves are smoked along with tobacco in asthma. According to Dutt, no mention of the latter use of the plant is to be found in old Hindu books, Mahometan writers also are silent upon this point. Ainslie found upon enquiry that the physicians of Southern India were unacquainted with the value of Datura in spasmodic asthma, but he tells us that his friend, Dr. Sherwood of Chittore, noticed the smoking of *D. fastuosa* as a remedy in that disease. In the Concan the juice of the same plant is given with fresh curds in intermittent fever to the extent of one tolá during the intermission, and at least two hours before the fever is expected. The seeds also often enter into the composition of the *bakha,* used in the fermentation of country spirits, and Norman Chevers states that *bakha* is also frequently added to Kaita (कैत), an intoxicating drink prepared from the fruit of *Feronia elephantum,* and indulged in by the lower classes during the Holi festival. The several species of Datura are described by Mahometan writers under the Arabic name of Jouz-el-mathil. The Persian name is Tátulah.* The author of the *Makhzan* recommends preference to be given to the purple kind; he says that all parts of the plant are powerfully intoxicating and narcotic; as a local application they relieve the pain of tumours, piles, &c. The roasted leaves applied to the eyes give relief in

* *Datura Stramonium* is called τάτουλα in modern Greek, a name doubtless of Persian origin. This plant is a native of Northern Persia and Afghanistan, whence it appears to have been introduced into Europe some time before the discovery of America.

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ophthalmia, similarly they are useful in headache, enlarged testicles, boils, &c. The following description of Datura intoxication is by the same author:—"Every thing he (the patient) looks at appears dark; he fancies that he really sees all the absurd impressions of his brain, his senses are deranged, he talks in a wild, disconnected manner, tries to walk but is unable, cannot sit straight, insects and reptiles float before his eyes, he tries to seize them, and laughs inordinately at his failure. His eyes are bloodshot, he sees with difficulty, and catches at his clothes and the furniture and walls of the room. In short, he has the appearance of a mad man." (*Makhzan*, article "*Jouz-el-mathil.*")

The leaves and seeds of *D. fastuosa* have been made official in the *Pharmacopœia of India*, and of these a tincture, extract, plaster and poultice are directed to be made. The extract has been used successfully at the General Hospital, Madras, as a substitute for extract of belladonna. The value of the plant as a remedy for painful syphilitic nodes, tumours, &c., is well known to many European physicians in India.

For a description of the physiological effects of Datura, the reader is referred to the article upon Belladonna.

Description.—The leaves of *D. Stramonium*, *D. fastuosa*, and *D. Metel* are very similar; they have long petioles, are unequal at the base, ovate, acuminate, sinuate-dentate, with large irregular pointed lobes; when fresh they are firm and juicy, and have a disagreeable fetid odour, which they lose when dry. In *D. Stramonium* and *D. Metel* the young leaves are generally pubescent, in *D. fastuosa* they are glabrous. In size the leaves vary greatly, in vigorous plants the largest are 7 to 8 inches long and 4 to 5 in breadth. All the species have large trumpet-shaped, night-scented flowers, which in *D. fastuosa* vary much in colour and are often double. In *D. Stramonium* they are white, and in *D. Metel* purplish-white.

The fruit is an ovoid capsule about the size of a walnut, thickly studded with blunt spines; it is bilocular, with each cell

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incompletely divided into two, and in *D. Stramonium* opens at the summit, when ripe, in four regular valves, disclosing a large number of flattened, kidney-shaped black or dark brown seeds, about 2 lines long and ½ a line thick. The surface of the seeds is finely pitted, and also marked with a much coarser series of shallow reticulations. The embryo follows the outline of the seed, and has the tip of the radicle everted. The fruit of *D. fastuosa* dehisces irregularly when ripe, and the seeds are ear-shaped and of a light yellowish-brown colour. The testa is much thicker than in the seeds of *D. Stramonium*, but like them is reticulated and finely pitted. The seeds of both plants have a bitterish taste and disagreeable odour when bruised. The fruit and seeds of *D. Metel* agree nearly with those of *D. fastuosa*.

Microscopic structure.—The outer envelope of the seed is formed of a layer of thick-walled, sinuous cells, which in *D. fastuosa* and *D. Metel* are much more developed than in *D. Stramonium*, and contain secondary deposits; the inner is formed of tangentially extended cells. The albumen consists of polyhedral cells, containing granular matter and fatty oil. The structure of the embryo is similar, but the cells are much smaller.

Chemical composition.—Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.* 1890, 511) found the seeds of *D. Stramonium* to contain much hyoscyamine with small quantities of atropine and hyoscine. M. Gérard (*Comptes rendus, Acad. des Sci.*, Aug. 11, 1890) has prepared a new fat acid, *Daturic acid*, from the seeds, which yield 25 per cent. of oil when extracted by ether. Purified with petroleum, this oil was of a greenish yellow colour. It was saponified with litharge; then the lead oleates were removed by ether, leaving a soap, from which the author isolated an acid fusing at 55° C. M. Gérard places daturic acid between palmitic and stearic acids, and it presents analogous properties to these. It crystallizes by cold from 85 per cent. alcohol giving groups of fine needles. It is fairly soluble in cold alcohol, and very soluble in ether and benzene.

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Formula $C^{34}H^{34}O^{4}$ (old notation). From *Répert. de Pharm.*, Sept. 10, 1890, in *Amer. Journ. Pharm.*, Oct. 1890. The air-dried seeds of *D. fastuosa* (purple var.) reduced to powder lost 7·828 per cent. of moisture when heated to 100° C. The ash calculated on the air-dried seeds amounted to 4·830 per cent., and was of a brick-red colour.

On proximate analysis the following results were obtained, calculated on the seeds containing 7·828 per cent. of moisture:—

Petroleum ether extract........................	11·654 per cent.
Ether extract, containing ·296 per cent. of oil soluble in petroleum ether	0·340 „ „
Absolute alcohol extract	1·382 „ „

The oil extracted by petroleum ether was of a pale straw colour, and had a slight odour of valeric acid. Exposed to a temperature of about 90—95° C. for several days, it slowly thickened. The oil extracted by ether was of a darker colour, and had a distinct fluorescence. After agitation with dilute sulphuric acid to dissolve any trace of alkaloid, and filtration through paper, it had a specific gravity at 15·5 C. of 9167. It thickened below 10° C. The ether extract contained oily matter soluble in petroleum ether, the insoluble residue was only partly soluble in dilute sulphuric acid, and the acid solution afforded marked evidence of the presence of an alkaloidal principle, which caused marked dilatation of the pupil when introduced into the eye. The alcoholic extractive contained a substance exhibiting a marked greenish fluorescence, a dark resin and an alkaloidal body. The gold salt of this alkaloid examined microscopically closely resembled the aurochloride of atropine. The total alkaloid extracted from the seeds amounted to ·088 per cent. Dragendorff states that the aurochloride of atropine dried at 100° C. contains 31·37 per cent. of gold; a salt having the formula $C^{17}H^{23}NO^{3}HAuCl^{4}$ would contain 31·31 per cent. of gold. We made two determinations of gold in the gold salt, prepared with alkaloid, after repeated purification; after drying first over sulphuric acid and

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then at 100° C., we found the gold content to be 30·513 per cent. The melting point of our gold salt was above 170° C. when heated in the dry state. The amount of alkaloid at our disposal was too small to admit of any attempt at fractionation.

Toxicology.—Datura poisoning is common in India, the seeds being usually employed; a few cases of poisoning by the leaves and root have, however, been reported. In the great majority of cases the motive for its administration is facilitation of theft, and when in India an individual has been first drugged and then robbed, it will usually be found that datura has been employed. A common form of theft by aid of this poison is road robbery, and Dr. W. Center mentions the use in such cases of a hollow pestle, the cavity containing the seeds. Inversion of this while pounding the *masaleh* or spices always used in Indian cookery, introduces the poison into the food without exciting suspicion. It rarely happens that there is any ground for suspecting homicidal intent in cases of datura poisoning; in fact, there seems to be a popular belief in this country that the drug is simply an intoxicant. As Harvey remarks, road poisoners sometimes partake with their victims of the drugged food, which they would hardly do if aware of the danger. Commonly, when datura is used for criminal purposes in India, the poison is mixed with sweetmeats or food, but in exceptional cases it has been mixed with tobacco given to the victim to smoke. Datura is said to be used by vendors of native liquor, for the purpose of increasing its intoxicating power, the liquor being poured into a vessel which has been first filled with the smoke of the burning seeds. Suicidal poisoning by datura, if it occurs at all, is extremely rare. Accidental poisoning among children is occasionally met with. (*Lyon, Med. Juris. for India.*)

For the symptoms of poisoning by this plant the reader is referred to the article upon Belladonna.

In a country where the habitual use of opium is so common it is difficult to say what may be a fatal dose of datura. Dr.

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Giraud in 1843 met with only one death in fifty-one cases admitted into the Jamsetjee Jeejeebhoy Hospital, Bombay; and in the ten years ending 1885, of fifty-nine cases admitted into the same hospital, only two died. This, however, is an exceptionally low death-rate. Dr. Burton Brown, of Lahore, records twenty-one deaths in ninety-two cases. In Harvey's one hundred and twenty-three Bengal cases, twenty deaths were reported; and of the Bombay Analyser's one hundred and thirty-eight cases, twenty-four died. Here there is a marked difference in the fatality among cases treated in hospital and the last three sets of figures which represent cases referred to the Chemical Analysers from different part of the country, many of which would probably have recovered under medical treatment.

From the Reports of the Chemical Examiner, N.-W. Provinces and Oude, for the years 1879 to 1887, it appears that out of 110 cases referred to him, 9 were fatal. His report also shows a remarkable decrease in the number of cases in which Datura was detected in the various substances sent to him for examination. In 1879 and 1880, 20 and 25 per cent. of them contained this poison, in 1881 the percentage fell to 9 and remained at about that figure during the remaining 6 years.

In Bengal fatal cases of datura-poisoning are now very rare, as will be seen from the following table :—

Year.	Number of viscera examined.	Percentage of Datura detections.
1880-81	270	0·7
1881-82	210	0·4
1882-83	210	None.
Nine months of 1883	126	,,
1884	217	,,
1885	234	,,
1886	266	0·4
1887	233	None.

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In the Punjab fatal cases are more frequent, but their number appears to be declining, as will be seen from the following figures:—

Year.	Number of viscera examined.	Percentage of Datura detections.
1879	162	1·8
1880	194	2·0
1881	186	6·3
1882	201	0·9
1883	194	1·5
1884	200	0·5
1885	234	0·8
1886	272	0·7
1887	228	0·8
Madras—		
1882	152	·6
1883	123	1·6
1884	85	8·2
1885	81	4·9
1886	84	2·3
1887	76	None.
1888	91	1·1
1889	101	1·9

A case is reported by Taylor (*Poisons*, p. 774) in which a decoction of 125 seeds of *D. Stramonium* caused the death of an adult in seven hours: on the other hand, in Dr. E. Lawrie's case (see Belladonna), the patient, an adult, recovered under suitable treatment, after taking four grains of Atropine.

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The following table, compiled by Assistant-Surgeon C. L. Bose, Assistant Chemical Examiner to the Government of Bengal, shows the particulars of poisoning by Datura in India:—

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
Bengal	1873	......	6	......	
Do.	1874	1	15	......	
Do.	1876	1	......	......	
Do.	1877	3	......	......	
Do.	1878	......	29	......	
Do.	1879	1	......	......	
Do.	1880	2	16 (Seeds) 1 (Root).	......	
Do.	1881	1	2 (Fruit) 14 (Daturine and Datura.)	......	
Do.	1882	1	17 (Datura seeds and Daturine.)	......	
Do.	1883	......	7 (Datura seeds and Daturine.) 1 (Datura root).	......	

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
Bengal—(*contd.*)	1884	......	7 (Datura) 1 (Datura and Asafœtida).	......	"Datura was not detected in any of the viscera examined during 1884. In the years commencing 1876-77 and ending 1882-83, datura was detected in one, three, none, one, two, one and one cases, respectively. Although not found in the viscera examined, datura was found in seven of the suspected substances and in three (?) other cases mixed with other poisons. From Satkhira, a female was reported to have been severely burnt and afterwards robbed by two persons who had been her guests for the night. It was suspected that these individuals poisoned the food of which she had eaten. Part of the remaining rice and meat were forwarded for chemical examination, and datura was detected in the meat." "Another of the cases was reported from Howrah. This case also was an attempt to drug a woman. One Ramnath Sircar and another person, name not yet known, poured a quantity of liquor from a bottle into a wineglass and offered it to the woman, who had no sooner taken the drink than she complained of a burning sensation in her throat, gullet and stomach, and immediately commenced to vomit. No poison was detected in the liquor or vomit, but datura was detected in the powder which was adhering to the interior of the wineglass."

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Do.	1885	......	1	......
Do.	1886	1	6	......
Do.	1887	......	8	1
Do.	1888	......	13	......
Do.	1889	1	25	......

In a paper contributed by me to the *Indian Medical Gazette* for October, 1890, recording medico-legal work in the Chemical Examiner's Department, Calcutta, during 6 months in 1889, the following cases were cited as cases of Datura poisoning that came under observation during the period.

"In the case of an up-country boy reported from Hoogly, the following history was forwarded:—

"The nephew states that he and his uncle and his uncle's son were travelling together; they met two men who gave them a mid-day meal and soon after left them. Some hours afterwards the son went to sleep and died in his sleep. The nephew was sick and drowsy. The father states that he was robbed by the men.

"On examining the viscera, the active principle of datura was detected."

"Of the cases of drugging by datura, the most important one occurred in Calcutta, in which one man in the course of a fortnight succeeded in non-fatally poisoning and robbing three persons. The victims were lying insensible on the roadside and were taken to the Campbell Hospital, their stomachs washed out, and the washings sent to the Chemical Examiner's Department for analysis. In one of these cases 46, in another 8, and in the third 11 entire and some broken fragments of seeds of datura possessing the physiological action of the active principle of the drug were detected in the washings of the stomach. In connection with this case, two packets of powder, found with the accused, were also sent for examination, and the active principle of datura was detected in them. The man feigned insanity at his trial in the Sessions Court, but he was sen-

Presidency.	Year.*	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					tenced to 7 years' imprisonment with hard labour. The man turned out to be a professional poisoner, and had been convicted of a similar offence in 1882 and sentenced to 5 years' imprisonment." "In three other cases of datura poisoning, no history was given, but in the rest the usual history of strangers taken into confidence, poisoning of the food and robbing of the victims was recorded."
Bengal—(*contd.*)......	1890	1	8	......	....
N.-W. P. and Oudh.	1865	......	1	......	"By the assistance of Major Manning, I have received from a professional poisoner retained at Benares under sentence of transportation as an approver, several specimens of datura in the proportions and in the forms usually administered. None of the doses of the powdered seed sent me exceeded in weight 25 grains, and this was asserted to be the amount usually given to produce insensibility in a full-grown man, mixed with one quarter of a seer of *suttoo* (grain parched or ground), the usual vehicle, the seed (reduced to the finest powder) is quite unrecognisable, by taste or by the microscope; the proportion in fact being 25 grains to 3,500."
Do.	1866	1	3	......	"Five cases of poisoning by datura were referred. In 4 of these I was able to detect the poison. The cases were briefly:—

"No 135. A case of domestic poisoning, in which a woman administered datura to a man and a boy in some *chapatees* (cakes); both individuals recovered, having been taken early to hospital. The poison was detected in the *chapatees* of which they had partaken. The case occurred at Lucknow."

"No 183. Is curious in the apparent absence of all object for the crime. A man, his wife and his daughter attended a *mela* (fair) in the Allahabad District. They accepted from a stranger about half a seer of *atta* (flour) in exchange for some tobacco. Three days after, on their return home, the *atta* was cooked and partaken of by the mother and daughter. Both became insensible and the daughter died. I detected datura in the *chapatees* made from the *atta*, as also in the contents of the girl's stomach."

"No 193. This case and the one following were the only two cases of gang or road poisoning referred during the year. The victim in this case was a *sowar* (trooper), by name Ghupli, who was returning from Saugor to his home at Lallutpur with a well-filled purse containing Rupees 310; falling in with a party of 5 men, they journeyed together until his companions found an opportunity of giving him datura mixed in sugar, to eat with his *suttoo*. He became insensible and lay thus for eight hours. When he came to himself, his purse and companions were gone; but he had sufficient strength to drag himself to the nearest police post and give information. The poisoners were pursued and apprehended, and luckily for justice, the sowar had retained, tied up in a piece of cloth, a small quantity of the sugar which had been given him. This contained datura in a state of fine division."

"No 194. This case occurred in the Futtehpore District. Six men belonging to a marriage party returning from Lallutpore were drugged by a professional poisoner in an encampment on the Grand Trunk Road. The drug was given in 'sherbet.' Two of the men died. I failed to

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					detect datura by analysis, but the poisoner confessed that he had given that poison mixed in the sherbet." "No 223. Was a domestic case which occurred at Fyzabad. Three persons were affected, but recovered, having been taken early to hospital. Datura was found in the *chapatees* of which they had partaken."
N. W. P. and Oudh—(*contd.*)	1867	......	......	......	Datura was detected in 5 cases, but whether in human viscera or among suspected articles, is not mentioned in the report.
Do.	1868	......	......	......	"Datura was detected as having been used for a criminal purpose in 12 cases. "Datura seems to be used in two classes of cases,—by the regular gang poisoners, and by men to produce a temporary insensibility in women with a criminal purpose in view. In the former class the poison is so carefully triturated by the practised hands who administer it, and the dose is so nearly proportioned to the effects intended to be produced, that rarely any evidence of the presence of the poison is obtained. In the 2nd class, the carelessness and ignorance of the operator generally leave satisfactory evidence of the instrument used to effect his ends."
Do.	1869	22	......	......	"In 22 cases of poisoning, datura was found to be the cause of death. Two of the datura cases were perfect examples of the cold-blooded and heartless system pursued by the regular professional poisoner." 1. "Three men and a boy were travelling last May, from Bombay towards the N.-W. Provinces. They were joined

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					at Hurdah by a man, who ingratiated himself by pleasant companionship, and every day, as they travelled, evinced his good fellowship by making sherbet for the whole party during their midday rest. At length, at a solitary spot on the banks of a stream near Bansa, in the Damoh District, they drank his sherbet for the last time; the three men were found dead and the boy roaming about close to their bodies in the restless delirium caused by datura. A man said to have been the poisoner was apprehended soon after in the Hosungabad District, and with him was found a carefully made powder of datura seeds, mixed with a little flour and sugar. I detected datura in the stomachs of all three victims of his heartless treachery. "In the other case, six men were seen to encamp near a village in the Moozuffernuggur District. After a time three of the men were found lying dead on the spot where they had encamped, their companions having disappeared. I found datura to have been the cause of death in all the three victims."
Do. .	1870	......	......	......	Datura was detected in 20 instances, but whether in human viscera or among suspected articles, is not mentioned.
Do. .	1871	......	......	......	Do. in 9 instances do.
Do. .	1872	......	4	......	"The detection of datura is far from being on a satisfactory basis. In 3 out of the 4 cases in which it was detected the seeds or parts thereof were appreciable to the eye or to the microscope, but in the 4th case (No. 149) I discovered the datura by its physiological test, dilatation of the pupil. It was a case which had come from Sultanpore in Oudh, and the substance to be examined was a *chapatee*, and it was from an extract of it that I obtained the test in a very characteristic way. I have not yet succeeded in getting this test from the extract of a stomach or its contents, although it has been tried in almost every case of Datura poisoning which has been reported to me."

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to con tain poison in connection with cattle-poisoning cases.	Remarks.
N. W. P. and Oudh—(*contd.*)	1873	......	......	......	Datura was detected in 26 instances; "in all these 26 instances in which it was found, it was in the contents of the stomach, in vomited matter, or in food."
Do.	1874	......	......	......	Datura was detected in 27 instances, but no mention is made whether the poison was detected in human viscera or among suspected articles.
Do.	1875	......	......	......	Do. in 23 instances do.
Do.	1876	......	......	......	Do. in 23 instances do.
Do.	1877	......	......	......	Do. in 28 instances do.
Do.	1878	......	......	......	Do. in 18 instances do.
Do.	1879	......	......	......	Do. in 20 instances do.
Do.	1880	......	......	......	Do. in 25 instances do.
Do.	1881	......	......	......	Do. in 9 instances do. In connection with one of these cases, "the Sessions Judge of Saharanpore sent a small parcel containing 150 datura seeds. I was asked first, if I could tell if these had been in a human stomach, and if so, how long; and, secondly, if instead of having been rejected by vomiting, they had been retained in the stomach of a woman, would they have caused death. To the first question, I could only answer that I did not know. To the second, I ventured to state that as the seeds were whole and also dry and hard, they would most probably not bring about a fatal issue, even if they had been retained in the woman's stomach."

N.-W. P. and Oudh—(contd.)	1882	......	......	......	Datura was detected in 11 instances, but no mention is made as to whether the poison was detected in human viscera or among suspected articles.
Do.	1885	......	......	......	Do. in 16 instances do.
Do.	1886	......	......	......	Do. in 21 instances do. Case "No 160 referred from Muttra. The substance examined was 5 sweetmeat balls, and they were suspected to contain datura. I found datura seeds, but that they were very small unripe seeds, and were so distorted in shape that their identity could only be made certain by preparing an extract from them and dropping it into the eye of a kid. The extract produced in a few minutes full dilatation of the pupil."
Do.	1887	......	......	......	Datura was detected in 14 instances, but no mention is made as to whether the poison was detected in human viscera or among suspected articles.
Bombay	1871	1	6	......	"The seven cases of poisoning in which portions of the datura plant, or of its alkaloid, were detected, include two deaths. In one of the fatal cases over 70 datura seeds were picked out of a piece of jowari cake, the remainder of which had been given to a man by his wife. In the other fatal case (circumstances not stated) the alkaloid was detected in the food given, in the matter vomited, and in the contents of the stomach. In two out of the five non-fatal cases, several persons were affected with symptoms of poisoning; in one of these cases the number of persons affected was stated to be 4, in the other the number is not given. Only one of the 18 cases of datura poisoning admitted into the Jamsetjee Jejeebhoy Hospital during the year under report is included in the 7 cases above mentioned."
Do.	1872	......	5	......	"Of the 5 cases in which datura was detected, in two the poison was contained in native bread, in two others the datura was detected in powders sent for examination, and in one case, the only fatal one of the five, the poison was found in the vomited matter of a patient in the Jamsetjee Jejeebhoy Hospital, who was admitted with marked

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					symptoms of datura poisoning, recovered and was discharged from hospital, but died 2 or 3 days afterwards. Cases of datura poisoning occurring in Bombay so rarely prove fatal that special interest attaches to this case, the symptoms, etc., of which are remarkable enough to be worth recording. While under treatment in hospital, the patient, an old woman, suffered from great tympanitic distension of the abdomen; this however was completely relieved before her discharge from hospital. She was dismissed from hospital seven days after admission, apparently quite well. Three days afterwards, or ten days after the administration of the poison, her death was reported. A *post-mortem* examination of the body was made, and from the notes of Dr. Anderson, House Surgeon, Jamsetjee Jejeebhoy Hospital, I gather that the following remarkable condition of parts was observed:—The abdomen was very greatly distended; on opening it the distension was found to be due to an enormously large stomach filled with fluid. No less than 4 gallons of fluid were contained in the viscus. At the lower part of the intestines three intussusceptions were found, but from the absence of any sign of inflammation in their neighbourhood, it was doubtful whether they were *ante-mortem* or *post-mortem* intussusceptions. As the intestines between the stomach and the seat of the intussusceptions were completely empty, it is very doubtful whether the dis-

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					tension of the stomach was in any way connected with the intussusceptions. Their presence however, taken in connection with the tympanitic state of the abdomen noticed during the time the patient remained in hospital, and with the distension of the stomach found at the *post-mortem* examination, makes the case a very remarkable one." Dr Giraud, in his account of Datura poisoning, quoted by Chevers (*Indian Medical Jurisprudence*, page 839) states,—"In four cases (of datura poisoning) I have met with deep coma, with insensibility, stertorous breathing, and in two of these there was a remarkable tympanitic state of the abdomen."
Bombay	1873	......	4	......	....
Do.	1874	......	9	......	"In most of the cases it seems to have been given with the object of producing stupefaction for purposes of robbery, and in one case, from what I could learn, it was placed in food with the design of getting up a false charge of drugging. In none of the suspected cases could I succeed in detecting it in the viscera." * * * This leads me to notice the fact mentioned in the last report of the Chemical Examiner at Calcutta, that the testa of a datura seed resembles that of capsicum so closely that it is in most cases impossible to distinguish them. This is quite true. A good deal has been said in favour of what was called the peculiar appearance of the testa of datura seeds under the microscope as reliable evidence of their presence. Knowing that capsicum, a member of a closely-allied genus, was a common constituent of native food, I took the trouble to compare it microscopically with datura, and finding the testa or outer covering of both seeds so nearly similar in appearance, I long since discarded the microscopic test for datura, preferring in all cases to rely only on its physiological action as the proof of greatest value."

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
Bombay – *contd.* ...	1875	1	8	.....	"The poison was detected in 9 cases, or the same number as last year: four of these nine cases came from the Central Provinces and Berars. The nine cases included the poisoning of no less than twenty individuals; only one death from the effects of the poison is however recorded. In all nine cases the poison seems to have been administered in food or sweetmeat, but with what object is not stated. In most of the cases, apparently, robbery was the object in view. In one however from Akola, in which the alkaloid was extracted from some food which had been partaken of by a man, who thereafter suffered from symptoms of datura poisoning, it is reported that the food in question was prepared by his wife. The following is the history of the single fatal case of poisoning by this drug above alluded to:—A family consisting of two men, their wives, and an old woman, their mother,—in all five persons,—lived in a hut in a lonely part of the Thar and Parkar District in Sind. One evening a man brought them some sweetmeat, of which all five proceeded to partake, but noticing that it had a bitterish taste, desisted after eating a small quantity. Twelve hours afterwards four of the five persons were found delirious, and suffering from the usual symptoms of datura poisoning, and the old woman was found dead. The alkaloid was eliminated from the contents of the stomach of the deceased. An attempt also was made to extract it from the liver, but without success."

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D.	1876	1	13	....	"Out of twenty persons, therefore, who suffered from symptoms of datura poisoning, only one died, and this was an old woman with a constitution probably weakened by age, and less capable of withstanding the effects of the drug. This seems to be the usual experience as to the mortality from datura poisoning among the cases before the Bombay Chemical Analyser. As a rule, the cases are not fatal. Every now and then, a fatal case occurs, and then it is found that the individual is either very young or advanced in years, or suffering from some disease. Fatal cases in healthy adults seldom occur. Possibly one reason of this small mortality among cases of datura poisoning may be due to the fact that the poison is generally given to facilitate robbery and not with any idea of causing death. It is curious, however, that the experience of datura poisoning in some other parts of India should show a far greater mortality than this. Dr. Burton Brown, of Lahore, quoted by Taylor and Chevers, speaks of a mortality of twenty-one cases out of ninety-two, or 22·8 per cent. On the other hand, Dr. Giraud records 51 cases of datura poisoning admitted into the Jamsetjee Jejeebhoy Hospital, Bombay, in 1848, without a single death." "The poison was detected in 14 cases as compared with 9 in each of the two previous years. The reports sent, record only that 5 persons were attacked with symptoms of datura poisoning; probably a much larger number of persons than this suffered, the reports sent with many of the cases being silent as to whether any individuals were poisoned or not. Two deaths from datura are included in the 14 cases. One of these was a case from Baroda; in this case, although the alkaloid was not detected in the viscera of the deceased, a powder of which the deceased made some pills and swallowed them some hours before death, was found to consist of powdered datura seeds. The other fatal case was that of a child poisoned by the

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					alkaloid. In this case, a child two years old, got hold of a small pill box in which a small quantity had been kept for use in ophthlamic practice by its father. Shortly afterwards it became insensible and convulsed, the pupils became widely dilated, and death took place with well-marked symptoms of datura poisoning. Another case which may be specially mentioned was the subject of a trial before the High Court, Bombay; this was a case of drugging in order to facilitate theft. A man while travelling by rail to Bombay, got into conversation with some fellow travellers, and accepted *pan-supari* from them; they on arrival took him to a house where he became insensible and was robbed: a portion of a powder said to have been given to complainant with the *pan-supari* was found to consist of powdered datura seeds. In 7 of the 14 cases, the identification of the poison depended on the extraction of the alkaloid; in the remaining 7 cases, the extraction of the alkaloid was not required, whole datura seeds, sufficiently perfect for identification, being present in the matter vomited and submitted for examination."
Bombay—(contd.) ..	1877	2	12	......	In seven cases the seeds were found, and in seven the poison was identified by its physiological action.
Do.	1878	.....	.....	.....	"Twelve cases in which datura was detected were referred during the year. These 12 cases included the poisoning of 17 persons, of whom eight died. In many of the cases

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the drug seems as usual to have been administered in order to facilitate the commission of theft. Thus in a case from Gadag, the history is as follows:—Two merchants started with a *tattoo walla* (pony man) from Hubli to buy cotton in the neighbouring villages. As they were starting a man and a woman offered themselves as guides, stating that they would show them the villages where cotton was to be had. At a halt, food was prepared by the woman, of which the merchants and the *tattoo walla* partook. All these became insensible and were robbed. One of the three died. Again in a case from Dholka, two women were poisoned with datura in sweetmeat; both died. The motive, in this case also, it was stated, was the facilitation of theft. The third case from Karmala was a case in which some thieves gave a powder, afterwards found to contain powdered datura seeds, to a cartman, and while he was insensible, robbed him. This case also terminated fatally. Probably, also, facilitation of theft was the motive in a case from Bhusaval, where a man was taken in a state of insensibility out of the Jubbulpore down mail. It was stated that he had been insensible for 16 hours. He died shortly after admission into hospital. A fellow-traveller of deceased confessed to having administered datura to him in some *gram* (chickpeas) and *dhall* (pulse) which he had given him to eat. In four other cases, where persons were poisoned with datura, the motive for the crime is not stated in the history of the case. In each of these cases, three persons were poisoned. In two of the cases the victims recovered, in the third all died. In the fourth case one individual was poisoned and recovered. In the remaining four cases possibly, also, persons were poisoned, but no statement to that effect accompanied the matters sent for examination. In two of these cases the substances forwarded were powders containing datura seeds. In a third case the alkaloid was found in some sweetmeat, and in the fourth case some sediment left in a

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
Bombay—(*contd.*) ..	1879	.... ..	......	.... ..	bottle, sent by the Poona City Magistrate, was found to contain the alkaloid. Although in the great majority of cases of poisoning by datura, the motive, as already stated, is to facilitate robbery, every now and then cases come under notice, where, from the poverty of the victims, it seems impossible that this could have been the case. In the town of Bombay, for example, some few years ago, beggars used constantly to be brought to the Jamsetjee Jejeebhoy Hospital, suffering from the symptoms of datura poisoning. It is possible that such cases may be explained in this way. I am informed that it is a popular belief that the utterances of persons, under the influence of datura, are oracular, and may be depended on as a guide to the success of undertakings, &c. It may be, therefore, that this is the solution of cases in which from the poverty of the persons poisoned, it is impossible that theft could have been the motive for administration of the drug." "Nine cases of poisoning by datura were referred during the year. These 9 cases embraced the poisoning of 19 persons, of whom 3 died. In 5 of the 9 cases more than one individual was poisoned. Of these 5 cases, one came from Gadak; in this case 4 men were poisoned, and a second case in which two men, both of whom died, came from Kaira. The other three cases were sent up by the Bombay Police, and appear all to have been cases of drugging for the purpose of facilitating commission of theft. In one of

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Do.	1880	2	6	......	these three cases, two persons—a man and a woman,—were poisoned, and in the third case, 4 men were poisoned. In the second of these Bombay cases, the only one of the three in which a death occurred, the amount of property stolen was considerable, its value being estimated at Rs. 2,500. The persons poisoned were two Punjabee merchants and their servant, and the individual suspected was a man whom they had engaged as a servant, and whom they had met while on their journey to Bombay. The third case occurred on the board the P and O. S. S. *Surat*, the individuals poisoned being two native passengers and two of the native crew. Of the 4 cases in which one person only was poisoned, one was also a Bombay case, and was a case, in which a prostitute, it was alleged, was drugged with datura, and then robbed of her ornaments by some men. A second case came from Kaira, and was one in which a man was poisoned by datura, his wife being the party suspected to have administered the poison. A third case was forwarded from Kaladgi; in this case a man was poisoned, datura seeds being found in the food which he had eaten, and also in a packet discovered in the house of the person accused. And the fourth and last case was forwarded by the Civil Surgeon of Satara; in this case a child was poisoned, the poison having been given in *goor* (coarse sugar)." "Eight cases in which datura was detected came under notice during the year, embracing the poisoning of 22 individuals, of whom two died. Enumerating these cases in the order in which they were received, the first case in the list was one from Sukkur, where 7 Mahomedans were, it is alleged, poisoned with datura at a Holi feast by some Hindus. Next we have a case from Shripur, where three men were poisoned by datura given to them in bread. The third case came from Ling Saugor, Hydrabad Assigned Districts, and was one in which two sweepers, of whom one died, belonging to a native regiment, were

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					poisoned by datura. The man who died, only lived, it is said, for 2 hours after taking the poison. The fourth case came from Borsad; in this case two men and a girl were poisoned, one of the men died 7 hours after taking the poison; the other two individuals recovered. In the fifth case from Poona, several boys were poisoned by some sugar given to them, which, on examination, was found to contain powdered datura seeds. In the sixth case from Karachi, the active principle of datura was detected in some cooked food forwarded for analysis. No history of this case was furnished to this office. The seventh case was from Jacobabad; in this case, two men were poisoned by datura, it was alleged, by a third, who afterwards robbed them; and lastly, the eighth was one from Borsad, in which a man complained to the Police that some one had put datura into his food; a portion of the food in question sent for examination was found to contain datura seeds."
Bombay—(*contd.*) ...	1881	......	2	......	"The two cases in which datura was detected during the year under report were as follows:—1. A case from Poona, in which a quantity of datura seeds were found in the possession of a man charged with the offence of drugging with a view to facilitate the commission of theft; and 2. A case from Sukkur, in which the active principle of datura was detected in some food which had been partaken of by three men, who thereafter suffered from symptoms of poisoning by datura."

Do.	1882	......	4	......	(*a*) Poisoned at a feast; (*b*) Poisoned by his wife; (*c and d*) No particulars forwarded with the poisoned food.
Do.	1883	1	5	......	"This poison was detected in 5 cases; in two, from the history, the poison appears to have been given for the purpose of facilitating the commission of theft. One of the cases was forwarded from Sorath in Kathiawar, and was a case in which 3 persons were drugged and afterwards robbed,—all three recovered. The other case occurred in Bombay, and was as follows:—The body of a man was found in a tank on the Esplanade with the feet tied together. *Post-mortem* examination of the body of the deceased indicated drowning to be the cause of death. Ornaments which deceased had been wearing a few hours before death were missing, and subsequently traced to the possession of two men in the company of whom deceased had been seen on the evening of his disappearance. On analysis atropine was found in the contents of the deceased's stomach, and one of the two accused is alleged to have stated that he had seen his companion put a powder into some liquor which he gave to the deceased. In 2 other cases, respectively, 6 and 5 persons appear to have been poisoned; in the first mentioned of these 2 cases (from Wadhwan) 3 of the 6 persons poisoned died. The history of these two cases is silent as to the motive for the crime. Lastly, in a case from Karachi, 18 Fakirs, all of whom recovered, were poisoned by datura given to them in sweetmeats. In this case also the history of the case does not throw any light on the motive for the crime."
Do.	1884	......	4	......	Involving ten persons—(*a*) Two, both recovered; (*b*) Do. (*c*) Three, all recovered; (*d*) Three, two recovered and one died.
Do.	1885	......	5	......	"The following is a summary of the five cases—all non-fatal, in which this poison was detected during the past year:—(1) In a case from Belgaum several persons—precise number not stated—suffered from symptoms of datura poisoning after eating food prepared from flour found, on examination, to contain the alkaloid of datura.

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					The accused in this case confessed to having mixed powdered datura seeds with the flour. (2) In a case from Bagevadi (Kaladgi District), the alkaloid was found in some sweetmeat given by one man to another, who, after partaking of it, was attacked by the usual symptoms of datura poisoning. The motive in this case was stated to be to make the poisoned individual 'mad on account of kept woman.' (3) In a case from Broach, a woman confessed to having put powdered datura seeds in her husband's food. The husband and 'others' who ate of the poisoned food were attacked. Datura seeds were found in accused's possession and identified. (4) In a case from Satara, in which five persons—two of them children—were poisoned, the alkaloid *daturine* was found in some fragments of breadcakes, some flour sent at the same time and said to be a portion of the flour from which the bread in question was made, was found to be free from poison. (5) Lastly, in a case from Hubli (Dharwar District), three children were poisoned, and datura seeds, whole and in powder, were found in possession of the accused. Some powder scraped from a grinding stone belonging to the accused was also found to contain the alkaloid.
Bombay—(*contd.*) ...	1886	......	4	......	All non-fatal, seeds identified.
Do.	1887	2	4	......	"The poison was detected in 5 cases during the year. In each of the 5, individuals were poisoned, and in 1 case there were two deaths. A summary of the 5 cases is as

					follows :—(1) A case from Sanand (Ahmedabad District), in which datura seeds were found in the contents of the stomach of each of two men, who suffered before death from symptoms of datura poisoning. (2) A case from Jalgaon (Khandesh District), in which some seeds found in the possession of a woman accused of poisoning 4 men with datura, proved, on examination, to be datura, seeds. (3) A case from Dakor (Kaira District), in which the active principle of datura was detected in some food. A portion of this food had been eaten by 4 persons, who, thereafter, were attacked with symptoms of datura poisoning—all recovered. The sufferers in this case were a man, his brother's wife and two servants. (4) A case from Belgaum in which some dregs taken out of a coffee-pot were found to contain atropine. In this case it was reported that a man and his family—number not stated—suffered from symptoms of datura poisoning after drinking coffee prepared in the pot from which the dregs had been taken. (5) A case from Karachi, in which atropine was extracted from some cooked rice. 8 persons, it was reported, had suffered from symptoms of datura poisoning after eating some of the rice sent for examination."
Do.	188	......	5	......	"5 cases of poisoning by this drug were reported during the year. In all five the alkaloid was detected in food which had given rise to symptoms of datura poisoning, *viz.*, in 1 case in bread, in 2 cases in flour, and in 2 cases in cooked vegetable food. In 1 of the 5 cases from Amraoti (Berars), the victims, it was stated, were 4 in number, and in another from Sorath (Native State), 2 persons, a man and a girl, were the sufferers. In each of the other 3 cases one person only was poisoned, the victim in each case being a male adult. Of these 3 cases 2 came from Anand (Kaira) and 1 from Haveli (Poona District). In 1 of the 2 cases from Anand the victim died. This was the only fatal case of poisoning by datura reported to this office during the year."

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
Bombay—(*contd.*) ...	1889	2	3	......	"Three cases of poisoning by this drug were forwarded for investigation during the year under report. The cases were:—A case from Uran (Thána District), in which two women had displayed symptoms of datura poisoning after partaking of some bread, but recovered upon treatment. Datura was found in the vomit and also in the bread. (2) A case from Dholka (Ahmedabad District), in which datura was detected in the viscera of a man who had been poisoned; datura seeds were found in the stomach of the deceased, and also adhering to a stone which the accused had used for pounding the seeds. (3) A case from Malegaon (Nasik District), in which a child, after eating some sweetmeat given to it by a neighbour, had exhibited narcotic symptoms and eventually died. Datura seeds were found in the contents of the stomach of the child."
Do.	1890	2	2	......	"These 4 cases include the poisoning of thirteen persons:—(*a*) A case from Haveri (Dharwar), in which 8 persons, after eating food, exhibited symptoms of datura poisoning, all recovered. (*b*) A fatal case from Tanna, no history forwarded. (*c*) A fatal case from Borsad (Kaira), no history. (*d*) A case in Bombay in which a brass-pot, containing datura seeds, was forwarded for examination; this case was in connection with the poisoning of 3 women who were treated in hospital; all recovered.

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Madras	1855	1	......	......	....
Do.	1868	1	......	......	....
Do.	1870	1	......	......	....
Do.	1871	1	......	......	....
Do.	1874	1	......	......	....
Do.	1875	1	......	......	....
Do.	1878	1	......	......	....
Do.	1879	2	2	......	....
Do.	1880	1	1	......	....
Do.	1881	3	1	......	....
Do.	1882	1	2	......	.... "Datura was detected in viscera only once. It was found once in some pills, and once in a powder, both of which were supposed to have been used with criminal intent."
Do.	1883	2	......	......	
Do.	1884	7	4	......	.... "Datura was discovered in 8 cases, some of which are worthy of record:—(a) Madura. The deceased man was supposed to have been drugged and thrown into a tank while in an unconscious state. The poison is believed to have been given in milk. Another man who partook of the suspected milk, suffered from vomiting and a bitter taste in the mouth, and is reported to have been delirious, clutching at imaginary objects for three days." "(b) Madura. Two men were drugged by poisoned milk while travelling by the South India Railway. One of them remained unconscious for two days. Both recovered. In this case a suspected powder was submitted for examination. No results were obtained with the alcoholic extract, but the alkaloid extracted by the Stas' process produced the physiological effects of datura." "(c) "Godaveri.—Three boys suffered from vomiting, tingling of the skin, delirium and clutching at imaginary objects shortly after taking some toddy. Datura was found in the vomited matters." "(d) Kistna.—After drinking arrack, three persons were affected with vomiting, delirium, and dilated pupils. Datura was found in the arrack.

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					"(*e*) Bellary.—Powdered leaves of *Datura fastuosa* were administered as an aphrodisiac." "Fourteen individuals were poisoned by datura, but in no case does a fatal result appear to have been due to the drug. The only death seems to have occurred from drowning while the victim was under the influence of datura.
Madras—(*contd.*)......	1885	4	2	......	Datura was detected in three cases:—(*a*) 4 persons were attacked with characteristic symptoms half an hour after taking food. (*b*) 6 persons were said to have suffered from the usual symptoms soon after taking food; datura seeds were discovered mixed with chilli seeds in the evacuations. The seeds were identified by their structural peculiarities, but no physiological effect could be obtained with them; they were apparently exhausted by maceration during their passage through the intestinal canal.
Do.	1886	2	2	......	Datura was found in 4 cases:—(*a*) A female traveller put up at a certain house. Soon after a meal, the seven inmates, not the traveller, were seized with giddiness, thirst, tingling in the throat, delirium and stupor. Evidence of datura was found in pepper water, and in a fragment of a cooking pot. (*b*) 23 persons, after a meal, were seized with symptoms of datura poisoning; all recovered. The alkaloid was found in the vegetable curry and in one parcel of vomit. (*c*) A suspected abortifacient drug consisted of datura seeds.

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Do.	1887	......	... ..	......	....
Do.	1888	1	3	......	Atropine was detected in three cases. The heading now includes cases in which no part of the plant used is available, the identification resting upon the discovery of a midriatic alkaloid; they were formerly included under "Datura."
Do.	1889	3	1	......	Datura and atropine were found in four cases alone, and mixed with ganja in one case. (*a*) Three chucklers, who were in the habit of stealing toddy off the trees, became more than usually intoxicated on one occasion, and one of them, who drank a larger quantity than the others, became insensible and died. Atropine was extracted from his stomach and from the toddy, in which were also found datura seeds. (*b*) In another, a woman committed suicide, owing to a quarrel with her husband, by eating the datura fruit; the seeds were found in her stomach, from which also the alkaloid was obtained. (*c*) Four persons became delirious after eating a pudding, and one of them became insensible and died; from the deceased's stomach atropine was extracted.
Do.	1890	......	6	......	Datura and atropine were detected in five cases alone, and together with arsenic in a sixth case. In the three cases of atropine no parts of the plant could be obtained, and only a midriatic alkaloid was extracted from the articles sent; while in the three cases returned under datura, some part of the plant was also available for identification. (*a*) Two persons after eating a morning meal, were affected with delirium, incessant talking, twitching of muscles, clutching at imaginary objects, fits of laughter, difficulty of swallowing, and dilatation of pupils. A magician, who was sent for to discover the cause of these symptoms, unwisely ate some of the food as an experiment and suffered similarly. In the meantime 6 other members of the family to whom food was sent out to the fields were found suffering in the same way, and one of them died. (*b*) Two brothers-in-law put datura seeds into the curry of three women, who were their neighbours, with malicious

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					intent, and were sentenced to 2 months' rigorous imprisonment. (c) A Bengali traveller joined a party of Mahometans who had returned from Mauritius, and were making their way down from Calcutta to Vizagapatam. On the way the Bengali contrived to poison his companions with datura, with the intention of robbing them, but he was foiled in his scheme, and was sentenced to 7 years' rigorous imprisonment.
Punjab	1862	......	......	......	Datura was detected in 4 instances; no further information available.
Do.	1863	......	......	......	Do. in 1 instance do.
Do.	1864	......	......	......	Do. in 3 instances do.
Do.	1865	......	......	......	Do. in 9 instances do.
Do.	1866	......	......	......	Do. in 7 instances do.
Do.	1867	......	......	......	Do. in 6 instances do.
Do.	1868	......	......	......	Do. in 6 instances do.
Do.	1869	......	......	......	Do. in 14 instances do.
Do.	1870	......	......	......	Do. in 7 instances do.
Do.	1871	......	......	......	Do. in 15 instances do.
Do.	1872	......	......	......	Do. in 9 instances do.
Do.	1873	4	16	......	"Datura is principally used by robbers to cause insensibility, and, indeed, no poison could be better adapted for the purpose, as in ordinary cases the victim rapidly becomes intoxicated, throws off his clothes and picks up dust and straw, and afterwards remains for some time in a state of idiocy or forgetfulness, that makes him unfit to give

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Do.	1874 1875 1876 1877 1878	Not available.			proper evidence, till the criminals may have made their escape. This state sometimes lasts for days, and is then probably due to whole seeds being swallowed, which, if not expelled by vomiting, may take some time to pass through the whole intestinal canal. Being extremely tough, they are not wholly dissolved or digested, and in one case in hospital whole seeds were found in the fæces. In cases of suspected datura poisoning the intestine should be therefore sent along with the stomach. In 3 fatal cases the whole seeds were found in the stomach; in 1 fragments were found. In 2 specimens of vomit, whole seeds were found; in 2 others, fragments. "The articles of food in which it was detected were cooked rice and *dall* (pulse), in which it had been put with capsicums which it rather closely resembles, and in 1 case in sweetmeats along with almonds and other seeds. "Among the drugs, it was found in one case pounded and made up in pills; in 2 in powders with aromatics; in 1, in a *masala* for food; in 1, adhering to a pestle and mortar; in 1 case it was mixed with tobacco; in the rest seeds or the pounded seeds were sent for identification. In all these cases, except 2, the examination for datura poisoning was made on account of suspicious seeds or fragments being found in the physical examination. When fragments were found they were identified by their microscopic characters, and the active principle was extracted and dropped into a cat's eye, causing dilatation of the pupil."

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle poisoning cases.	Remarks.
Punjab—*contd.*	1879	3	16	......	"Datura, the Thug poison, is almost always used to facilitate robbery. It not unfrequently causes death, as will be seen from the statistics. Three of the cases referred ended fatally, and two of these were sent up as cases 'found dead,' the Civil Surgeon being unable from the *post-mortem* appearance to certify the cause of death, and forwarding the viscera as a precautionary measure."
Do.	1880	4	22	......	"In the non-fatal cases (in which vomit or excreta were sent) datura was detected in 15 instances; while datura seeds, powdered, were found in 6 cases in food and once in drugs."
Do.	1881	12	26	......	In the non-fatal cases datura was detected in 8 instances in vomited matters; in 18 instances in food articles and drugs.
Do.	1882	2	16	......	In the non-fatal cases datura was detected in 5 instances in the excreta, in 9 instances in food and in 2 in the drugs forwarded.
Do.	1883	3	14	......	Datura was detected in 6 instances in vomited matter, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1884	1	21	......	Datura was detected in 10 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1885	2	14	......	Datura was detected in 5 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded.
Do.	1886	2	12	1	Datura was detected in 1 instance in vomited matters, in 6 in food articles, and in 5 in the drugs forwarded.

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Do.	1887	2	3	......	In connection with cattle poisoning cases, datura was detected in 1 instance mixed in a ball of *atta* (flour). Datura was detected in 2 instances in food articles, and in 1 instance in the drugs forwarded.
Do.	1888	4	.....	......	....
Do.	1889	7	54	......	....
Do.	1890	Not available.		......	....

The following cases of Dhatura poisoning have been recorded by Dr. Brown in his book ("*Punjab Poisons*"):—

"Case No. 23.—Extracted from the Indian *Lancet* of August, 1st, 1860, reported and treated by Dr. Aitchison:

"Busunki, aged 35, employed as a Chaudari, had been ill for some time with a cough for which he went to a native hakim, and on November 23rd, 1859, at 8 a. m., he took some medicine; on arriving at his own house about half an hour afterwards, he complained of headache and feverishness, and went about nearly naked; he was also restless, moving about from place to place, and was attacked by convulsive fits.

"He was seen at half past seven in the evening, at which time he was in a state of unconsciousness, with greatly dilated pupils. He continued in a state of restless delirium, incessantly tossing his head from one side to another. The pulse was slow and the mouth dry.

"He vomited after an emetic was given, and then began to stare about and talk deliriously; afterwards he had two convulsive fits in which he foamed at the mouth.

"The next morning he was less delirious, and the pupils were natural. He remained unconscious till the 3rd day, and then recovered his senses, but he became weaker; and on November 28th, five days after he had taken the poison, he died from exhaustion. On enquiry it was found that he had never had any fits before this illness. The patient was treated at first with emetic of mustard flour and hot water, afterwards cold affusion was applied to the head and Carbonate of Ammonia administered internally as a stimulant. On the second day castor oil was given as a purgative."

"No. 24.—Case No. 75 of 1866, Punjab Records.—A man visited a house while food was being cooked; he left suddenly and the three persons who partook of the food were taken ill and one died. Dhatura seeds were found in the food, and also on the person of the man, who was sentenced to death."

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					The accused in this case confessed to having mixed powdered datura seeds with the flour. (2) In a case from Bagevadi (Kaladgi District), the alkaloid was found in some sweetmeat given by one man to another, who, after partaking of it, was attacked by the usual symptoms of datura poisoning. The motive in this case was stated to be to make the poisoned individual 'mad on account of kept woman.' (3) In a case from Broach, a woman confessed to having put powdered datura seeds in her husband's food. The husband and 'others' who ate of the poisoned food were attacked. Datura seeds were found in accused's possession and identified. (4) In a case from Satara, in which five persons—two of them children—were poisoned, the alkaloid *daturine* was found in some fragments of breadcakes, some flour sent at the same time and said to be a portion of the flour from which the bread in question was made, was found to be free from poison. (5) Lastly, in a case from Hubli (Dharwar District), three children were poisoned, and datura seeds, whole and in powder, were found in possession of the accused. Some powder scraped from a grinding stone belonging to the accused was also found to contain the alkaloid.
Bombay—(*contd.*) ...	1886	......	4	......	All non-fatal, seeds identified.
Do.	1887	2	4	......	"The poison was detected in 5 cases during the year. In each of the 5, individuals were poisoned, and in 1 case there were two deaths. A summary of the 5 cases is as

					follows :—(1) A case from Sanand (Ahmedabad District), in which datura seeds were found in the contents of the stomach of each of two men, who suffered before death from symptoms of datura poisoning. (2) A case from Jalgaon (Khandesh District), in which some seeds found in the possession of a woman accused of poisoning 4 men with datura, proved, on examination, to be datura, seeds. (3) A case from Dakor (Kaira District), in which the active principle of datura was detected in some food. A portion of this food had been eaten by 4 persons, who, thereafter, were attacked with symptoms of datura poisoning—all recovered. The sufferers in this case were a man, his brother's wife and two servants. (4) A case from Belgaum in which some dregs taken out of a coffee-pot were found to contain atropine. In this case it was reported that a man and his family—number not stated—suffered from symptoms of datura poisoning after drinking coffee prepared in the pot from which the dregs had been taken. (5) A case from Karachi, in which atropine was extracted from some cooked rice. 8 persons, it was reported, had suffered from symptoms of datura poisoning after eating some of the rice sent for examination."
Do.	188	......	5	......	"5 cases of poisoning by this drug were reported during the year. In all five the alkaloid was detected in food which had given rise to symptoms of datura poisoning, *viz.*, in 1 case in bread, in 2 cases in flour, and in 2 cases in cooked vegetable food. In 1 of the 5 cases from Amraoti (Berars), the victims, it was stated, were 4 in number, and in another from Sorath (Native State), 2 persons, a man and a girl, were the sufferers. In each of the other 3 cases one person only was poisoned, the victim in each case being a male adult. Of these 3 cases 2 came from Anand (Kaira) and 1 from Haveli (Poona District). In 1 of the 2 cases from Anand the victim died. This was the only fatal case of poisoning by datura reported to this office during the year."

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
Bombay—(*contd.*) ...	1889	2	3	......	"Three cases of poisoning by this drug were forwarded for investigation during the year under report. The cases were:—A case from Uran (Thána District), in which two women had displayed symptoms of datura poisoning after partaking of some bread, but recovered upon treatment. Datura was found in the vomit and also in the bread. (2) A case from Dholka (Ahmedabad District), in which datura was detected in the viscera of a man who had been poisoned; datura seeds were found in the stomach of the deceased, and also adhering to a stone which the accused had used for pounding the seeds. (3) A case from Malegaon (Nasik District), in which a child, after eating some sweetmeat given to it by a neighbour, had exhibited narcotic symptoms and eventually died. Datura seeds were found in the contents of the stomach of the child."
Do.	1890	2	2	......	"These 4 cases include the poisoning of thirteen persons:—(*a*) A case from Haveri (Dharwar), in which 8 persons, after eating food, exhibited symptoms of datura poisoning, all recovered. (*b*) A fatal case from Tanna, no history forwarded. (*c*) A fatal case from Borsad (Kaira), no history. (*d*) A case in Bombay in which a brass-pot, containing datura seeds, was forwarded for examination; this case was in connection with the poisoning of 3 women who were treated in hospital; all recovered.

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Madras	1855	1	......	......	....
Do.	1868	1	......	......	....
Do.	1870	1	......	......	....
Do.	1871	1	......	......	....
Do.	1874	1	......	......	....
Do.	1875	1	......	......	....
Do.	1878	1	......	......	....
Do.	1879	2	2	......	....
Do.	1880	1	1	......	....
Do.	1881	3	1	......	....
Do.	1882	1	2	......	.... "Datura was detected in viscera only once. It was found once in some pills, and once in a powder, both of which were supposed to have been used with criminal intent."
Do.	1883	2	......	......	....
Do.	1884	7	4	......	"Datura was discovered in 8 cases, some of which are worthy of record:—(a) Madura. The deceased man was supposed to have been drugged and thrown into a tank while in an unconscious state. The poison is believed to have been given in milk. Another man who partook of the suspected milk, suffered from vomiting and a bitter taste in the mouth, and is reported to have been delirious, clutching at imaginary objects for three days." "(b) Madura. Two men were drugged by poisoned milk while travelling by the South India Railway. One of them remained unconscious for two days. Both recovered. In this case a suspected powder was submitted for examination. No results were obtained with the alcoholic extract, but the alkaloid extracted by the Stas' process produced the physiological effects of datura." "(c) "Godaveri.—Three boys suffered from vomiting, tingling of the skin, delirium and clutching at imaginary objects shortly after taking some toddy. Datura was found in the vomited matters." "(d) Kistna.—After drinking arrack, three persons were affected with vomiting, delirium, and dilated pupils. Datura was found in the arrack.

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					"(*e*) Bellary.—Powdered leaves of *Datura fastuosa* were administered as an aphrodisiac." "Fourteen individuals were poisoned by datura, but in no case does a fatal result appear to have been due to the drug. The only death seems to have occurred from drowning while the victim was under the influence of datura.
Madras—(*contd.*)......	1885	4	2	......	Datura was detected in three cases:—(*a*) 4 persons were attacked with characteristic symptoms half an hour after taking food. (*b*) 6 persons were said to have suffered from the usual symptoms soon after taking food; datura seeds were discovered mixed with chilli seeds in the evacuations. The seeds were identified by their structural peculiarities, but no physiological effect could be obtained with them; they were apparently exhausted by maceration during their passage through the intestinal canal.
Do.	1886	2	2	......	Datura was found in 4 cases:—(*a*) A female traveller put up at a certain house. Soon after a meal, the seven inmates, not the traveller, were seized with giddiness, thirst, tingling in the throat, delirium and stupor. Evidence of datura was found in pepper water, and in a fragment of a cooking pot. (*b*) 23 persons, after a meal, were seized with symptoms of datura poisoning; all recovered. The alkaloid was found in the vegetable curry and in one parcel of vomit. (*c*) A suspected abortifacient drug consisted of datura seeds.

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Do.	1887	......	......	......	....
Do.	1888	1	3	......	Atropine was detected in three cases. The heading now includes cases in which no part of the plant used is available, the identification resting upon the discovery of a midriatic alkaloid; they were formerly included under "Datura."
Do.	1889	3	1	......	Datura and atropine were found in four cases alone, and mixed with ganja in one case. (*a*) Three chucklers, who were in the habit of stealing toddy off the trees, became more than usually intoxicated on one occasion, and one of them, who drank a larger quantity than the others, became insensible and died. Atropine was extracted from his stomach and from the toddy, in which were also found datura seeds. (*b*) In another, a woman committed suicide, owing to a quarrel with her husband, by eating the datura fruit; the seeds were found in her stomach, from which also the alkaloid was obtained. (*c*) Four persons became delirious after eating a pudding, and one of them became insensible and died; from the deceased's stomach atropine was extracted.
Do.	1890	......	6	......	Datura and atropine were detected in five cases alone, and together with arsenic in a sixth case. In the three cases of atropine no parts of the plant could be obtained, and only a midriatic alkaloid was extracted from the articles sent; while in the three cases returned under datura, some part of the plant was also available for identification. (*a*) Two persons after eating a morning meal, were affected with delirium, incessant talking, twitching of muscles, clutching at imaginary objects, fits of laughter, difficulty of swallowing, and dilatation of pupils. A magician, who was sent for to discover the cause of these symptoms, unwisely ate some of the food as an experiment and suffered similarly. In the meantime 6 other members of the family to whom food was sent out to the fields were found suffering in the same way, and one of them died. (*b*) Two brothers-in-law put datura seeds into the curry of three women, who were their neighbours, with malicious

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					intent, and were sentenced to 2 months' rigorous imprisonment. (c) A Bengali traveller joined a party of Mahometans who had returned from Mauritius, and were making their way down from Calcutta to Vizagapatam. On the way the Bengali contrived to poison his companions with datura, with the intention of robbing them, but he was foiled in his scheme, and was sentenced to 7 years' rigorous imprisonment.
Punjab	1862	......	......	......	Datura was detected in 4 instances; no further information available.
Do.	1863	......	......	......	Do. in 1 instance do.
Do.	1864	......	......	......	Do. in 3 instances do.
Do.	1865	......	......	......	Do. in 9 instances do.
Do.	1866	......	......	......	Do. in 7 instances do.
Do.	1867	......	......	......	Do. in 6 instances do.
Do.	1868	......	......	......	Do. in 6 instances do.
Do.	1869	......	......	......	Do. in 14 instances do.
Do.	1870	......	......	......	Do. in 7 instances do.
Do.	1871	......	......	......	Do. in 15 instances do.
Do.	1872	......	......	......	Do. in 9 instances do.
Do.	1873	4	16	......	"Datura is principally used by robbers to cause insensibility, and, indeed, no poison could be better adapted for the purpose, as in ordinary cases the victim rapidly becomes intoxicated, throws off his clothes and picks up dust and straw, and afterwards remains for some time in a state of idiocy or forgetfulness, that makes him unfit to give

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					proper evidence, till the criminals may have made their escape. This state sometimes lasts for days, and is then probably due to whole seeds being swallowed, which, if not expelled by vomiting, may take some time to pass through the whole intestinal canal. Being extremely tough, they are not wholly dissolved or digested, and in one case in hospital whole seeds were found in the fæces. In cases of suspected datura poisoning the intestine should be therefore sent along with the stomach. In 3 fatal cases the whole seeds were found in the stomach; in 1 fragments were found. In 2 specimens of vomit, whole seeds were found; in 2 others, fragments. "The articles of food in which it was detected were cooked rice and *dall* (pulse), in which it had been put with capsicums which it rather closely resembles, and in 1 case in sweetmeats along with almonds and other seeds. "Among the drugs, it was found in one case pounded and made up in pills; in 2 in powders with aromatics; in 1, in a *masala* for food; in 1, adhering to a pestle and mortar; in 1 case it was mixed with tobacco; in the rest seeds or the pounded seeds were sent for identification. In all these cases, except 2, the examination for datura poisoning was made on account of suspicious seeds or fragments being found in the physical examination. When fragments were found they were identified by their microscopic characters, and the active principle was extracted and dropped into a cat's eye, causing dilatation of the pupil."
Do.	1874 1875 1876 1877 1878	Not available.			

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle poisoning cases.	Remarks.
Punjab—*contd.*	1879	3	16	......	"Datura, the Thug poison, is almost always used to facilitate robbery. It not unfrequently causes death, as will be seen from the statistics. Three of the cases referred ended fatally, and two of these were sent up as cases 'found dead,' the Civil Surgeon being unable from the *post-mortem* appearance to certify the cause of death, and forwarding the viscera as a precautionary measure."
Do.	1880	4	22	......	"In the non-fatal cases (in which vomit or excreta were sent) datura was detected in 15 instances; while datura seeds, powdered, were found in 6 cases in food and once in drugs."
Do.	1881	12	26	......	In the non-fatal cases datura was detected in 8 instances in vomited matters; in 18 instances in food articles and drugs.
Do.	1882	2	16	......	In the non-fatal cases datura was detected in 5 instances in the excreta, in 9 instances in food and in 2 in the drugs forwarded.
Do.	1883	3	14	......	Datura was detected in 6 instances in vomited matter, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1884	1	21	......	Datura was detected in 10 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1885	2	14	......	Datura was detected in 5 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded.
Do.	1886	2	12	1	Datura was detected in 1 instance in vomited matters, in 6 in food articles, and in 5 in the drugs forwarded.

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					In connection with cattle poisoning cases, datura was detected in 1 instance mixed in a ball of *atta* (flour).
Do.	1887	2	3	......	Datura was detected in 2 instances in food articles, and in 1 instance in the drugs forwarded.
Do.	1888	4	......	......	....
Do.	1889	7	54	......	....
Do.	1890	Not available.		......	....

The following cases of Dhatura poisoning have been recorded by Dr. Brown in his book ("*Punjab Poisons*"):—

"Case No. 23.—Extracted from the Indian *Lancet* of August, 1st, 1860, reported and treated by Dr. Aitchison:

"Busunki, aged 35, employed as a Chaudari, had been ill for some time with a cough for which he went to a native hakim, and on November 23rd, 1859, at 8 a. m., he took some medicine; on arriving at his own house about half an hour afterwards, he complained of headache and feverishness, and went about nearly naked; he was also restless, moving about from place to place, and was attacked by convulsive fits.

"He was seen at half past seven in the evening, at which time he was in a state of unconsciousness, with greatly dilated pupils. He continued in a state of restless delirium, incessantly tossing his head from one side to another. The pulse was slow and the mouth dry.

"He vomited after an emetic was given, and then began to stare about and talk deliriously; afterwards he had two convulsive fits in which he foamed at the mouth.

"The next morning he was less delirious, and the pupils were natural. He remained unconscious till the 3rd day, and then recovered his senses, but he became weaker; and on November 28th, five days after he had taken the poison, he died from exhaustion. On enquiry it was found that he had never had any fits before this illness. The patient was treated at first with emetic of mustard flour and hot water, afterwards cold affusion was applied to the head and Carbonate of Ammonia administered internally as a stimulant. On the second day castor oil was given as a purgative."

"No. 24.—Case No. 75 of 1866, Punjab Records.—A man visited a house while food was being cooked; he left suddenly and the three persons who partook of the food were taken ill and one died. Dhatura seeds were found in the food, and also on the person of the man, who was sentenced to death."

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"Case No 25.—Gogaira, January 1860.—A man named Furida went to the house of Mussammat Hatim one evening, while her husband was absent, and took an opportunity of mixing some dhatura seeds with the rice that she was cooking, as he afterwards confessed. Mussammat Hatim, another woman, and an old man partook of the rice when it was cooked, but the poisoner refused to do so. Shortly after eating, Mussammat Hatim was attacked with extreme giddiness, and her mouth and throat became very dry, and subsequently she became insensible as did also the other two.

"The next morning the two women were seen to rush from the house in a very excited manner, tearing off their clothes till they were almost naked, and throwing about bricks like mad people. On entering the house, the old man was found insensible, lying on his bed and clutching at it; his breathing was loud and as if his throat was filled with phlegm; he was perfectly unconscious and remained so for three days. The two women recovered on the second day, one of them declared that she had been raped while insensible.

"An infant also partook of a portion of the food and became insensible. Seeds of dhatura were found on the prisoner, who alone was quite unaffected by any illness."

"Case No 26.—Another very interesting case in which death occurred happened at Umballa in 1861. A man named Din Muhammad was sent with some money to Umballa; on his way he met with a person named Devera, with a companion. These persuaded him to drink some liquid which they had mingled with pounded datura seeds, as they afterwards confessed.

"Shortly after Din Muhammad had drunk this, he complained of feeling thirsty and confused. He was seen to stagger about as if drunk, and then to fall and become senseless. From this condition he was roused by pouring cold water over his head; he then got up and began to roam about like a mad man and to strip off all his clothes.

"Afterwards he ran up a tree and jumped off into thorns, and then began to run about laughing and singing, and to eat earth. Subsequently he fell down and died, vomiting before death"

"Case No. 26.—Lahore, November 2nd, 1859.—Lulloo had been married to Kirpoo for 14 years without having any children. He therefore asked Muhammad Shah to give them some medicine which would produce fertility. This was done at their own house, while they and the poisoner were alone present. Half an hour afterwards the male sufferer felt his head going round, and subsequently he became insensible, as also did his wife. They were found by the man's brother in an insensible state, and the woman remained so for three days, and then died, but the man recovered.

"The prisoner confessed that he had given dhatura."

"Case No. 27.—This case happened at Kasauli in the Punjab, and was investigated there on the 24th August 1860. From the evidence it appeared that Ballu, a Brahmin, was travelling with his brother and some cartmen, and also another Brahmin, named Sadanand; that on July 21st, the last person prepared a dish called *chori* made of *chuppaties* (cakes) and sugar, of which the two brothers ate rather largely, the cartmen sparingly, and the prisoner Sadanand not at all. Very shortly afterwards the two brothers were taken ill and became insensible; the cartmen appeared also as if intoxicated, but the prisoner was not affected. Ballu died the next day, remaining insensible up to the time of his death.

"The prisoner confessed that he had ground dhatura seeds to powder, and mixed them with the food. In consequence none were detected on examination of the contents of the stomach of the deceased, but this was found to be very much inflamed."

"No. 28.—Case No. 112 of 1862, Umritsar.—Two men became insensible after eating some *dhall*; they remained so for several hours, but ultimately recovered. A large quantity of white dhatura was found in the *dhall* left."

"No 29.—Case No 5 of 1869, Hissar.—Three persons began to suffer from thirst, dryness of the mouth, and vomiting half an hour after taking some food; they then became drowsy and delirious; the pupils of the eyes were seen to be dilated; they remained delirious for two days and nights and then recovered. Dhatura seeds were found in the sugar which they had eaten."

"No 30. Case No 27 of 1868 from Panjab Records for 1868.—Some travellers leaving Lahore were joined by a stranger, who supplied them with *atta* and two of them also took some native liquor from him: they soon became ill, and appeared like drunken men: they were taken to Umritsur and treated for poisoning by dhatura. One man who had taken the spirit died in a few days, the rest recovered. No dhatura was found, and the prisoner was acquitted."

"No 31.—Case No. 38 of 1869, Jullunder.—Five persons of the same family became insensible after taking some food and remained so for 24 hours, after which they recovered, but their pupils were seen to be dilated. Dhatura seeds were found in the vomited matters."

"No 32.—Case No. 12 of 1876, from the Panjab Records for 1876.—The accused confessed that he had administered dhatura to his wife, as he said, to frighten her. She and another woman partook of the food into which the poison was introduced, and both became intoxicated and suffered from vomiting and purging, but recovered. The accused was sentenced to 2½ years' rigorous imprisonment, but no compensation was awarded to the sufferers."

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"No 33.—Case No. 31 of 1870, Delhi.—Five persons partook of food together, but all complained of a peculiar bitter taste, and one hour afterwards they were all attacked by headache and giddiness. They all became stupefied, but complained of cramps and twitchings of the limbs. They were unable to stand, but fell down and kept on rolling about. They all vomited, and then recovered. Dhatura seeds were found in the vomited matters."

"No. 34.—Case No. 121 of 1870, Lahore.—A Sikh ate some *dahi* (curdled milk). Half an hour afterwards, he began to be delirious and threw off his clothes; he vomited and gradually recovered. Dhatura seeds were found in the vomited matters."

"No. 35.—Case No. 130 of 1868, Muzaffargarh.—A man became insensible in less than one hour's time after drinking some buttermilk, and died in 8 hours. Dhatura seeds were found in the milk."

"No. 36.—Case No. 205 of 1869, Karnal.—Two men partook of some *Majun** with which dhatura seeds had been mixed by a third man, who afterwards confessed it. Both the men became insensible, and were conveyed to the hospital, where they were found to be in a state of complete coma with dilated pupils and stertorous breathing; no pulse could be felt at the wrist, and both soon died. Dhatura seeds were found in the stomach of each of them."

"No. 37.—Case No. 61 of 1886, Umballa.—A woman and a child became delirious after eating some food, but both vomited, and then recovered. Dhatura seeds were found in the food in poisonous quantity."

"No. 38.—Case No. 111 of 1866, from Hissar.—A poisoner was reported to have killed at least 15 persons, as he was in the habit of giving poisoned sweetmeats to travellers who afterwards became insensible and many died. Dhatura seeds were found in a little bag in his clothes."

An account of 32 cases of dhatura poisoning was given by Assistant-Surgeon Nil Ratan Bannerjee in the *Indian Medical Gazette* for 1885, page 209. All but four recovered.

* A kind of sweetmeat.

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SCOPOLIA LURIDA, *Dunal.*

Fig.—*Link & Otto Ic. Sel., t.* 35; *Miers Ill. S. Amer. Pl. II., t.* 78; *Sweet Brit. Fl. Gard., t* 125.

Hab.—Central Himalaya, Nepal, Sikkim.

History, Uses, &c.—The properties of this plant do not appear to be known to the natives of India. It was introduced into Europe as a garden plant by the late Mr. Whitley of Fulham in 1823, and is of the most easy culture, and will grow in any soil, but requires a dry situation. (*Loudon.*) In the *Pharmacopœia of India* it is stated that a tincture prepared from the leaves, in the proportion of one ounce to eight ounces of alcohol, administered to different patients, was found to produce extreme dilatation of the pupil; and in two instances it induced blindness, which only disappeared when the medicine was discontinued. The largest dose given was 20 drops of the above tincture during the twenty-four hours. (*Op. cit. p.* 181.) These experiments were reported in the *Gaz. Med. Nov.* 4th 1843) and appeared in *Braithwaite's Retrospect of Med. IX.*, p. 119. Of late years other species of Scopolia, especially *S. japonica*, have attracted attention in Europe as substitutes for belladonna.

Description.—*S. lurida* is a strong, robust, downy, canescent plant, with something the habit of Belladonna, and solitary, drooping, lurid yellow or greenish-purple flowers. The leaves resemble those of Datura. The fruit is globose, about $\frac{3}{4}$ inch in diameter, circumsciss above the middle, lid one-celled, remainder two-celled; seeds numerous, reniform, granulate, $\frac{1}{12}$ inch.

Chemical composition.—*S. lurida* has been examined by Siebert. (*Archiv. der Pharm. Feb.* 20, 1890, *p.* 145.) From flowering plants he reports that he obtained, by fractional precipitation of an acidulated liquid with gold chloride, a "not inconsiderable quantity of hyoscyamine," but no atropine or hyoscine, while from plants collected when the seed had ripened, only a very small quantity of atropine could be isolated

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under the same conditions and no hyoscyamine. The failure to detect hyoscine is thought to be possibly due to insufficiency of the material used. These results seem to indicate that the degree of development of the plant may have an important relation to the quantity and nature of the alkaloids occurring in it. (*Pharm. Journ. Mar.* 1*st,* 1890, *p.* 709.)

HYOSCYAMUS NIGER, *Linn.*

Fig.—*Bot. Mag., t.* 2394; *Bentl. and Trim., t.* 194; Henbane (*Eng.*), Jusquiame noire (*Fr.*).

Hab.—Temperate Western Himalaya. Cashmere to Gurhwal.

HYOSCYAMUS MUTICUS, *Linn.*

Fig.—*Jaub. et Spach. Ill.* v., *t.* 415; *Griff. Ic. Pl. Asiat., t.* 412. Syn.—*H. insanus,* Stocks.

Hab.—West Punjab, Sind, Afghanistan.

HYOSCYAMUS RETICULATUS, *Linn.*

Fig.—*Commelyn Hort.,* 77, *t.* 22.

Hab.—Beluchistan, Badghis, Khorasan. The herb and seeds.

Vernacular.—Khorasáni-ajowán (*Hind., Beng.*), Khorasáni-ova (*Mar.*), Khorasáni-ajamo (*Guz.*), Kúráshání-yomam (*Tam.*), Kúrásáni-vámam (*Tel.*), Khurásáni-vádakki (*Can.*),

History, Uses, &c.—Henbane, though a native of the Himalayas, was probably unknown to the ancient Hindu physicians. Parasika and Khorasáni yamáni, the names which it bears in some recent Sanskrit works, indicate its foreign source. Three kinds of ὑοσκύαμος were known to the Greeks, μελας black, λευκος white, and μηλοειδης. yellow. Hyoscyamus is called Altercum and Herba symphoniaca by Latin writers. Cf. *Pliny,* 25, 17, who states that alterum is its Arabian name. It is probably a corruption of الترياق originally a Persian word signifying an "antidote," in Greek θηριακα. In Palladius and other late

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writers we meet with the mutilated form Jusquiamus. Mahometan writers call it Banj, an Arabic corruption of the Persian Bang; they say it is the Afiyun (ὄπιον) of the Greeks, the Azmálús of the Syrians, and the Katfít or Iskírás of the Moors; they also add that in the Deilami language it is called Kír-chak, because the capsules resemble a little basket with a cover, such as the Arabs make out of date leaves and call Kafír. Baron Hammer-Purgstall makes the following important observation: *Bendj*, the plural of which in Coptic is '*nibendj*,' is without doubt the same plant as the '*nepenthe*,' which has hitherto so much perplexed the commentators of Homer. Helen evidently brought the nepenthe from Egypt, and bendj is there still reputed to possess all the wonderful qualities which Homer attributes to it." (*Trébutien* "*Contes Inédits des Mille et une Nuits*," i, p. 12, note.) Mír Muhammad Husain's description of Banj in the *Makhzan* agrees well with the genus Hyoscyamus. He says there are three kinds—white, black, and red, and that the white is to be preferred; he mentions the preparation of a sun-dried extract from the juice of the fresh leaves, and says that the leaves are also pounded and made into a paste with flour, out of which small cakes are formed, which when dry retain their medicinal properties for some time. Henbane is described by Eastern writers on Materia Medica as intoxicating, narcotic and anodyne; among the many uses to which it is put the following may be mentioned as now peculiar to the East. A poultice of the juice with barley flour is used to relieve the pain of inflammatory swellings. The seeds in wine are applied to gouty enlargements, inflamed breasts, and swelled testicles. About half a drachm of the seeds with 1 drachm of poppy seeds is made into a mixture with honey and water, and given as an anodyne in cough, gout, &c.* Equal parts of the seeds and opium are said to be a powerful narcotic. A mixture of the powdered seeds with

* Compare with Scrib. Comp. 89 to 93. The smoke of the burning seeds was inhaled by the ancients to cure toothache. (Scrib. Comp. 54.) Suffire autem oportet ore aperto alterci semine carbonibus asperso, subinde os colluere aqua calida, interdum enim quasi vermiculi quidam ejiciuntur. (See *Solanum xanthocarpum*.)

pitch is used to stop hollow teeth which are painful, and also as a pessary in painful affections of the uterus. The juice or a strong infusion of the seeds is dropped into the eye to relieve pain. Lastly, the seeds made into a paste with mare's milk and tied up in a piece of wild bull's skin if worn by women, is said to prevent conception. Ainslie and other European writers upon Indian Materia Medica notice the use of Hyoscyamus seeds in India.

The officinal Henbane of the ancients is generally considered to have been *H. albus*, Linn., and in the Mufaridát-i-Násari the seeds are described as Bazr-el-banj-abiad, "seeds of white henbane." Pliny mentions four kinds of the plant, the first with a black seed, flowers bordering on purple, and a prickly stem, growing in Galatia (*H. reticulatus*); the second, or common kind (*H. niger*); the third having seeds like *Irio*, *i. e.* "reddish" (*H. aureus*, Linn.); and the fourth with white seeds, which is preferred by medical men (*H. albus*). All of them have, he says, the effect of producing vertigo and insanity. The Henbane seeds brought from Khorasán are those of *H. reticulatus*. This plant has also been sent to us from Quetta, where it grows abundantly. *H. niger* is cultivated at the Saharanpur Botanic Gardens, where the extract is also manufactured for use in the State Sanitary Establishments. The physiological effects of Hyoscyamus are the same as those of Belladonna, which have already been described. In certain conditions of the system the action of the drug, and especially of hyoscyamine, appears to be considerably modified, as will be seen from the following cases quoted by Stillé and Maisch. "Dr. H. A. Hutchinson, of Pittsburg, took ¼ grain of Merck's hyoscyamine (*Phila. Med. Times*, xiii. 139.) Besides the dryness of the mouth and throat, there was intense congestion of the head and face and violent throbbing of the heart and carotids, numbness over the whole body and muscular incoördination, and an inability to walk without watching the steps. There was no mental excitement or sensory illusion, but an over-powering tendency to sleep, which came on and lasted for 11 hours. Various means were used by friends who were ignorant of the cause of the

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sopor to arouse the sleeper, but uselessly. During the sleep the muscular system was completely relaxed, and the pulse at first was full and hard, 138 a minute, the respirations 34 to 40, and the temperature 106° F. As the narcotism subsided these rates subsided rapidly toward the normal standards. On regaining consciousness the mind was unsteady and confused, and all objects looked tinged with yellow. During the sleep there was more or less nausea, and once vomiting. No recollection of anything after the commencement of sleep remained. For several days the pupils remained dilated, and there was double vision, while all the secretions, including the perspiration, were suspended. A patient of Empi's affected with paralysis agitans took 5 mgm. of hyoscyamine (gr. $\frac{1}{12}$), and, finding the tremor diminished, used a like quantity on the following day. The first dose caused a slight intoxication, and after the second there was a like confusion of the mind and senses, the face was flushed, the expression anxious, the whole interior of the mouth dry, the tongue stiff, and nausea was experienced. Hallucinations in which rats and serpents appeared, and familiar persons were not recognized, were accompanied and followed by furious delirium, tetanic spasms, and extreme dilatation of the pupils. Deglutition was impossible; the respiration was hurried and oppressed, the pulse at 96; and constant vesical tenesmus existed. The attack lasted for 3 hours, and gradually subsided, and on the morrow only some recollection of the hallucinations remained. (*Bull. de thérap.*, xcix. 373.) A phthisical patient accustomed to hypodermic injections of morphia was given $\frac{1}{40}$ grain of hyoscyamine. After vomiting he became delirious, lost all correct perception of the distance of objects, and constantly caught at insects, with which he said his bed-clothes were covered. (*Practitioner*, xxii. 369.) In some forms of hypochondriasis hyoscyamine seems to have been useful as a means of calming agitation. Prolonged experience has confirmed these statements. Prideaux states (*Practitioner*, xxiii. 446) that it produces sleep, sometimes of considerable duration, in excited conditions of the brain, as in mania, delirium tremens, meningitis, and where ordinary

hypnotics, and especially opiates, are inadmissible. In such cases small doses ($\frac{1}{16}$ gr.) suffice, but in chronic mania large doses (½ grain, or even 1 grain) are necessary, and are very useful in cutting short exhibitions of temper and excitement of a violent and destructive character. It would appear to be particularly useful in delusional insanity; the illusions which it conjures up overlie and gradually obliterate those which belong to the disease. In chronic dementia, associated with destructive tendencies, bad habits, and sleeplessness, the patients are much improved by a course of small doses of the drug. (*Stillé and Maisch.*) Of late years the hydrochlorate of hyoscine has been recommended as calmant in maniacal excitement in doses of one-half to one milligram. It is claimed for it that there are no injurious after-effects, and that it is a good hypnotic, but at the same time its depressing influence on the system is admitted, and it appears to have been of no use in a considerable proportion of the cases in which it was tried. There can be no doubt that much of the discrepancy which is observable in the records of the medicinal effects of hyoscyamine, is due to the use of impure or inert samples of the alkaloid.

Description.—The bazar seed is reniform, laterally compressed, equal in size to that of *H. niger*, of a greyish-brown colour. The testa is finely reticulated. The albumen is oily. The embryo curved like the figure 9, the tail of the 9 being represented by the radicle. The taste is oily, bitter and acrid.

Microscopic structure.—The outer envelope of the seed is composed of a row of large cells, the outer walls of which are thin but the lateral and interior very much thickened. The second layer is made up of very small cells tangentially extended and closely applied to one another. The cells of the albumen are polyhedral, and contain granular matter and oil globules.

Chemical composition.—Henbane contains *Hyoscyamine*, $C^{17}H^{23}NO^{3}$, an isomeride of atropine. It occurs both in the seeds and in the juice of the different species of Hyoscyamus, and is accompanied by *Hyoscine* or amorphous hyoscyamine.

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It crystallizes in needles (from dilute alcohol), or prisms (from $CHCl^3$), is more soluble in water and dilute alcohol than atropine, and is lævorotatory, $[\alpha]_D = -21°$. It enlarges the pupil of the eye in the same manner as atropine.

Hyoscyamine occurs mixed with atropine in several plants of the Solanaceæ, such as Datura, Duboisia, Atropa, and probably in some others. Ladenburg is of opinion that atropine is an optically inactive base standing to hyoscyamine in the relation of racemic acid to lævotartaric acid. From 20 grams of commercially pure atropine aurochloride he isolated by recrystallization one gram of hyoscyamine aurochloride, and to this he attributes the statement that atropine can be converted into hyoscyamine. Hyoscyamine is converted into atropine by heating it for 5 or 6 hours above its melting point. Its optical activity may likewise be diminished by allowing its alcoholic solution to stand in the cold after a slight addition of one of the following bases: NaOH, KOH, NH^3, NMe^2H, and NMe^4OH, but cannot be reduced below $[\alpha]_D = -1{\cdot}89°$ by this method; so that if Ladenburg is correct in holding atropine to be optically inactive, the conversion of hyoscyamine into atropine is incomplete. Hyoscyamine is split up by boiling dilute HCl or baryta water into the same products as atropine, *viz.*, tropine and tropic acid.

Hyoscine or amorphous hyoscyamine $C^{17}H^{23}NO^3$, is a colourless syrupy fluid, and occurs in the mother-liquor from which hyoscyamine has crystallized. It closely resembles hyoscyamine, both in its mydriatic action on the pupil and in other respects. Boiled with water it splits up into tropic acid and pseudo-tropine. (*Watt's Dict. of Chem*, 2d. Ed. II., 744.)

Henbane seeds contain 26 per cent. of fatty oil, and according to Warnecke yield 4·51 per cent. of ash.

Toxicology.—No clearly authenticated cases of poisoning by Hyoscyamus appear to have been recorded in India, but its use has occasionally been suspected in the Punjab and Beluchistan, where *H. muticus* is common. Under the name of *Kohi-bhang*, "hill bhang," its intoxicating properties are well known to the

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natives, and it is stated to be smoked like Ganja, and sometimes used in the same way as Datura to facilitate robbery.

NICOTIANA TABACUM, *Linn.*

Fig.—*Lam. Ill. t.* 113; *Wight Ill. t.* 166; *Bentl. and Trim. t.* 191. Tobacco (*Eng.*), Tabac (*Fr.*).

Hab.—America. Cultivated throughout India. The herb.

Vernacular.—Tambákú (*Hind.*, *Mar.*), Támáku (*Beng.*), Pugai-ilai (*Tam.*), Pogáku, Dhúmra-patramu (*Tel.*), Puka-yila, Pokala (*Mal.*), Hogesappu (*Can.*), Tamakú (*Guz.*).

History, Uses, &c.—In the Encyclopædia of Sanskrit learning by Rája Rádhákánta Deva, entitled Sabdakalpadruma, tobacco is mentioned under the name of Támrakúta. This name occurs in the Kulárnava-tantra as that of one of eight intoxicating agents. No Sanskrit medical writers mention Tobacco. Támrakúta is a word compounded of Támra, "a red or copper colour," and kúta, "deceitful or vile," and the Hindi name Tambáku may possibly be derived from it and not from the Portuguese, in which case Tobacco has usurped the place of some older but now forgotten drug. From the *Maásir-i-rahimi* and the *Dára-shikohi* we learn that tobacco was introduced into the Deccan by the Portuguese about A. H. 914 (A. D. 1508), and that it began to be smoked about 1605, towards the end of the reign of Sultán Jaláleddeen Akbar. Rumphius speaks of it as having been known from a remote period in the East, and it appears to have been introduced into China in the 16th century probably by way of Japan or Manila. In Europe the Spaniards first became acquainted with Tobacco on the discovery of Cuba in 1492, and introduced it into Spain as a valuable medicinal herb. Gonzalo Fernandez de Oviedo y Valdés, governor of Domingo, in his *Historia general de las Indias*, printed at Seville in 1535, states that the plant is smoked by the Indians through a branched tube of the shape of the letter Y, which they call *Tabaco*.

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In the edition of 1570 of Estienne and Liebaut's *L'Agriculture et Maison Rustique*, Nicot's own account of the herb, which was called after him *Nicotiane*, is given. In it he relates the wonderful cures which were effected by it at Lisbebron (Lisbon), where he was resident as French ambassador to the Court of Portugal in 1559-60 and 61. Nicholas Monardes in 1517 published a full account of the uses of Tabaco, the proper name of which amongst the Indians he says, is *Picielt*; and in 1577 "*Joyfull newes oute of the newe founde worlde,*" by John Frampton, appeared, in which the Spanish and French accounts of the plant are reproduced in English. Frampton describes himself as a retired Spanish merchant. Tobacco was first brought to England by Sir John Hawkins about the year 1565, but was not used for smoking by Englishmen until many years after.

Smoking appears to have been first taught in England under the following circumstances:—

Sir Walter Raleigh's first expedition took possession of Virginia on July 13th, 1584, and after a six weeks' stay in the country, returned home. The next year, a second expedition conveyed out a colony under Master Ralph Lane, which remained in the country from August 17th, 1585, to June 18th, 1586: when Sir Francis Drake with his fleet, returning from his victorious raid in the West Indies, brought home the colony to the number of 103 persons. Among these was the celebrated mathematician, Thomas Hariot, who in his, "*Briefe and true report of the new found land of Virginia, &c.,*" London, 1588, describes tobacco, and the adoption of the smoking of it by these Virginian colonists. It would therefore appear that Raleigh himself had nothing to do with the introduction of the weed itself, or of the habit of smoking it. But while Sir Walter introduced neither the herb nor the manner of smoking it, there is a general consent that he principally brought the habit of Tobacco-smoking, or, as it was at first called, Tobacco-drinking, into fashion, and a string of stories of a humorous character are on record which connects his name with it. For these stories

we must refer the reader to Arber's reprint of King James' famous "*Counterblaste to Tobacco.*"

From George Sandys' travels in 1610 we learn that tobacco smoking was becoming common among the Turks at that date, and that it had been introduced into the country by the English merchants.

Like coffee drinking, the use of tobacco met with much opposition at first, and even at the present day is visited with the severest penalties by the Wahabis. Sandys remarks that tobacco from England would prove a principal commodity in Turkey were it not for the severity of Morat Bassa (Murad Pasha), who commanded a pipe to be thrust through the nose of a Turk who was caught smoking, and that he should be led in derision through the city. The Mahometan law doctors in Arabia and Turkey universally condemned its use, in Persia* and the East they appear to have been less severe. In the former country "to fill a pipe for any one" is a vulgar expression for doing a favour. Mulla Fauki says:—

آن یکی پهلو زندکانیک بسر قلیان ناز
کرده ام بتنباکوی لطفی که از من نکذری

A Sofi praises tobacco in the following terms:—

آن جوانانیکه تنباکوکشند .·. اولش اللّه و آخر هوکشند

"Who drink tobacco; breathe Allah first, then God."

The liberal policy of Akbar probably prevented any persecution in India; in China its use was prohibited by the emperors both of the Ming and Tsing dynasties. In Russia up to the time of Peter the Great snuff-taking was forbidden under the penalty of having the nose cut off.

In England Ben Jonson, in *Every Man in his Humour*, acted on 25th November, 1596, skilfully represented both sides of the controversy in the speeches of Bobadilla and Cob. From this date up to 1604 numerous writers appeared in defence or condemnation of the herb. King James 1st then wrote his well

* Tobacco was introduced into Persia by the Portuguese in the reign of Shah Abbas the Second.

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known *Counterblaste*, and published a *Commissio pro Tabacco*, by which be placed a duty of six shillings and eight pence upon every pound imported into England, in addition to the custom of twopence which was before levied. Offenders against this act were liable to confiscation, fine and corporal punishment.

Even now the controversy is not extinct in England, but Tobacco appears to have the best of it, and in all other countries, except in the Wahabi territory, it reigns supreme. Nának Shah indeed when he established the Sikh religion thought it necessary to forbid the use of something, and selected tobacco as the forbidden article, but, nevertheless, he allowed converts who had been in the habit of using it to continue the practice.

The author of the *Makhzan-el-Adwiya* states that native physicians consider tobacco smoke to be disinfectant, and recommend it for fumigating cholera patients. Taken in various ways it is said to purge the brain and stimulate mental activity. The smoke is calmative in asthma and other chest affections, and prevents costiveness if inhaled fasting. The ashes of the plant made into a paste with oil are a useful application to sores and wounds to prevent bleeding. The water from the *hookah* is diuretic, and the black oil which collects in the pipe stem is used on tents to heal up sinuses, and is dropped into the eye to cure night blindness and purulent conjunctivitis. Mir Muhammad Husain closes his notice of Tobacco by remarking that the better classes of English in India smoke the *hookah*, but in their own country they mostly take snuff, a few chew, and smoke pipes (the author of the *Makhzan* wrote about one hundred and twenty years ago). Ainslie mentions the application of the leaves to the anus to promote the action of the bowels by the natives of Southern India. In the Concan a paste made with snuff, lime and the powdered bark of *Calophyllum inophyllum* is applied in orchitis. Dr. Leith of Bombay was in the habit of applying a poultice of Tobacco leaves to the spine in tetanus with good results. The use of Tobacco is very general amongst the natives of India, even women and young children habitually smoke and chew it. The Gúrákú which is used in the *hookah* is essentially a mixture of Tobacco and Gur (coarse sugar), in

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equal proportions, but the wealthier classes add other ingredients to it.*

Guraku has the appearance of an extract; when used it is broken into fragments which are packed in the *chilam* and covered with a layer of live coals of wood, or rice balls specially prepared for the purpose. In Western India cigarettes rolled in the leaves of *Bauhinia racemosa* or *Diospyros Tupru* are much used. Many among the labouring classes chew Tobacco along with their betel leaves and areca nut. Snuff-taking also is very common in some parts of India.

Physiological effects.—Tobacco acts as a poison upon most insects, but is fed upon with impunity by weevils. In frogs, nicotine, after a period of temporary excitement, causes a tetanic condition; sometimes accompanied by convulsions, and followed by muscular ralaxation. Herbivorous animals are not affected by moderate doses injected into the stomach, but large doses reduce the frequency of the pulsations of the heart, and may prove fatal to them. The carnivora are affected by it in the same way as man. When its fumes are thrown into the lungs of animals, or when its decoction is applied to their skin its poisonous operation is speedily developed. Tobacco first

* Apples and *Sumbul*, the root of *Nardostachys Jatamansi*, according to the author of the *Makhzan*, who resided for many years at Murshidabad. Dr. K. L. Dey "*On the Use of Narcotics and Stimulants and their Effect upon the Human Constitution*," Calcutta, 1868, gives the following as the composition of the two kinds of *Guraku* commonly used in Bengal:—1st quality, Mild or Bhalsah—Tobacco leaf powder 72 parts, Powdered scents 16, Treacle 88, Ripe Champa plantains 16, Ripe Jack fruit juice 2, Ripe Pineapple juice 1 part. The ingredients to be thoroughly mixed, and the mixture to be allowed to ferment for 6 months.

2nd quality, Strong or Mitla Kurrah—Tobacco leaf powder 12 parts, Tobacco leaf rib powder 6, Powdered scents 2, Treacle 22, Slaked lime 1 part. The ingredients to be thoroughly mixed; it is then ready for use. The following is the composition of the powdered scents:—Root of *Nardostachys Jatamansi* 5 parts, Cassia bark 10, Juniper berries 2, Sandal wood 2, Leaves of *Artemisia Sieversiana* 5, Bdellium 1, cloves 1, Patchouli 5, Capsules of *Xanthoxylon hastile* 5, Alkekengi 5, Storax 5, Tobacco powder to serve as a vehicle for preserving the scents 49. The ingredients to be thoroughly powdered, mixed and sifted.

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stimulates the spinal cord, giving rise to convulsions and afterwards paralyses it. The convulsions are of spinal origin in the frog, but those which occur before death in mammals are probably asphyxial. (*C. Bernard, C. Rouget, L.-Brunton.*)

On man the minutest doses of nicotine ($\frac{1}{32}$ to $\frac{1}{16}$ grain) occasion a burning sensation in the tongue, a hot, acrid feeling in the fauces, and sense of rawness throughout the œsophagus. Salivation is abundant. Small doses produce a sense of heat in the stomach, chest, and head, and even in the fingers, with some excitement of the nervous system; larger ones cause heaviness, giddiness, torpor, sleepiness, indistinct vision, with sensitiveness of the eye to light, imperfect hearing, laborious and oppressed breathing, and dryness of the throat. In 40 minutes after the larger doses a sense of great debility is perceived, the head droops, the pulse-rate falls, the face grows pale, the features are relaxed, the limbs seem paralyzed, the hands and feet are cold, the coldness advances gradually toward the trunk, and faintness ends in loss of consciousness.

The disorder of the digestive organs manifests itself by eructations, nausea, and even vomiting, the abdomen becomes distended, and an urgent desire is felt to go to stool; wind is discharged and urine voided copiously. The nervous system, after the debilitating influence of the poison has developed itself, shows its condition by muscular spasm, which begins with tremulousness of the extremities, and gradually involves the whole muscular system, including the respiratory muscles, so that the breathing is oppressed, gasping, and incomplete.

This enumeration of effects is sufficient to prove that nicotine acts primarily upon the spinal and sympathetic nervous systems, and not upon the brain. It may cause death by direct paralysis of the heart, or more indirectly by paralysis of the respiratory muscles, producing asphyxia. The blood examined during life of a person under the full influence of tobacco presents a striking disaggregation of the red corpuscles, which are also less regularly circular than natural, and have jagged or crenated edges. As the poisonous operation passes off, however, the

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blood regains its normal characters. The action of tobacco itself is so nearly identical with that of nicotine as to render unnecessary a detailed account of it It, however, is mainly exhibited in muscular relaxation and collapse. In some cases "lethargy" and "insensibility" are mentioned, but the condition is not that of cerebral oppression so much as of cerebral exhaustion. Of other symptoms especially prominent in certain cases of tobacco-poisoning, either caused by a single excessive dose or by inordinate indulgence in smoking or chewing tobacco, may be mentioned: a rapid followed by a very slow pulse, hiccough, and cold perspiration, profuse diuresis, convulsions without loss of consciousness, sometimes cataleptic and sometimes hysterical, and great numbness as well as impaired motor power of the limbs and of the tongue. (*Stillé and Maisch.*)

Tobacco is now hardly ever used medicinally. Formerly it was applied to certian cutaneous eruptions such as scabies, and as a palliative in rheumatism and other painful affections, but its local application, if the skin be broken, is dangerous, and its administration in the form of enema, to induce muscular relaxation or remove worms, has often been followed by alarming symptoms. The value of tobacco smoking as a palliative in the paroxysms of asthma is well established, and in some cases its use appears to affect a permanent cure.

There can be no doubt that the moderate use of tobacco smoking is not injurious to a great many people, but it is equally certain that on some constitutions it produces mischievous effects. For a full account of the injurious action of the excessive use of the herb by smoking, snuffing, or chewing, Stillé's *Therapeutics* may be consulted. He shows that it lessens the natural appetite, more or less impairs digestion, and induces constipation, while it irritates the mouth and throat, rendering it habitually congested and impairing the purity of the voice. It induces a constant sense of uneasiness and nervousness, with epigastric sinking or tension, palpitation ("irritable heart"), hypochondriasis, impaired memory, neuralgia, and frequent urination. Chewing and snuffing tend to

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cause gastralgia, but smoking causes neuralgia of the fifth pair. It renders the vision weak and uncertain, causing objects to appear nebulous, or creates muscæ volitantes and similar subjective perceptions. Analogous derangements of hearing occur, with buzzing, ringing, etc., in the ears, and even hallucinations of this sense. Often there is a feeling of a rush of blood to the head, with vertigo and impairment of attention, so as to prevent continuous mental effort; the mind is also apt to be filled with crude and groundless fancies leading to self-distrust and melancholy. The sleep is frequently restless and disturbed by distressing dreams. It impairs muscular power and co-ordination, probably both by interfering with nutrition and by exhausting nervous force, and usually keeps down the growth of muscle and the deposit of fat. Lauder-Brunton remarks that the effects produced on the system by tobacco smoking may be partly due to nicotine, but are probably rather due to products of its decomposition, such as *pyridine* and *collidine*. In pipe-smoking pyridine preponderates, but when tobacco is smoked in cigars, where there is free access of air, the chief product of the dry distillation undergone by the tobacco is collidine, which is far less active than pyridine, and this may partly account for the fact that many Europeans who have resided for some years in India, are unable to smoke a pipe, but can smoke many times the equivalent of a pipeful of tobacco in the form of cigars with impunity.

In those accustomed to smoke tobacco, it has a soothing effect on the nervous system, but it often acts as a nervous stimulant to mental work, as in reading. In these cases the effect is probably not due to the nicotine itself, but to the stimulus of the smoke on the sensory nerves of the mouth, which reflexly stimulates the vaso-motor centre, and dilates the vessels of the brain; since some people produce the same effect by sucking sweets, or sipping whisky and water.

Description.—Tobacco-leaves are from 6 to 20 inches long, and from 2 to 6 inches broad, oval or ovate-lanceolate, sometimes rather obovate in form, pointed and acute at the

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apex, and with an entire margin. In the fresh state they are rather thick, green, and covered with viscid hairs and with small sessile glands; after drying they are thinner, lighter or darker brown, or mottled with different shades of brown, and friable. The leaves have a thick, prominent midrib, branching under acute angles into lateral veins, which are curved near the margin. The odour of tobacco is peculiar and heavy, and its taste disagreeable, bitter, and acrid.

The variety *rustica*, Linn., is chiefly cultivated in India.

Chemical composition.—Tobacco contains a large amount of salts, consisting of sulphates, nitrates, chlorides, phosphates, and malates of potassium, calcium, ammonium, and nicotine, and yields from 14 to 18·5 per cent. of ash. Larger amounts have been obtained, sometimes as much as 25 to 27 per cent. —a result which is probably due in some cases to dust adhering to the viscid glands, as was suggested by B. F. Creighton (1876). The other constituents of tobacco are albumen, resin extractive, gum, citric acid (*Goupil*), and nicotianin.

Nicotianin was discovered by Hermbstädt on distilling tobacco with water; it separates from the distillate in the form of white foliaceous crystals, which have an odour resembling that of tobacco-smoke and a warm and bitterish aromatic taste. (Posselt and Reimann, 1828.) Landerer (1835) obtained nicotianin from the dried, but not from the fresh leaves. Barral (1845) stated that it contains 7·12 per cent. of nitrogen.

Nicotine or *nicotia* is the poisonous principle of tobacco, and was discovered by Posselt and Reimann (1828). It may be prepared by exhausting bruised tobacco with acidulated water, concentrating the infusion, adding an excess of potassa, and agitating with ether, which dissolves the alkaloid, and on the addition of powdered oxalic acid, nicotine oxalate, which is insoluble in ether, is separated (*Schloesing*): or, the ether is evaporated, the liquid neutralized with oxalic acid, evaporated to dryness, and the residue exhausted with boiling alcohol which dissolves oxalate of nicotine. (*Ortigosa.*) On evaporating the solution to a syrupy consistence and agitating it with potassa and ether, an ethereal liquid is obtained, which on

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fractional distillation yields the alkaloid. This is a colourless oily liquid, having at 15° C. the specific gravity 1·0111, and remaining liquid at —10° C. It has an unpleasant, and when heated a pungent, acrid, tobacco-like odour, a burning taste, and a strongly alkaline reaction. Exposed to air and light, it rapidly acquires a brown colour and is partly converted into a resinous compound. It boils near 250° C., but distils at a lower temperature, always leaving a residue. Its composition is $C^{10}H^{14}N^2$. It absorbs water from the air, dissolves readily in water, and is separated from this solution by caustic potassa. Alcohol and ether dissolve it in all proportions, and it yields with acids neutral and acid salts, of which the former crystallize with difficulty, and are mostly soluble in weak alcohol, but insoluble in ether. The alkaloid acquires a wine-red colour with strong sulphuric acid, and on heating the mixture is charred. Chlorine gas colours it deep-red or red-brown. When heated with a little hydrochloric acid a violet colour is produced, which on the further addition of nitric acid changes to yellowish-red. The double salts with mercuric and platinic chloride are sparingly soluble in cold water. Dried tobacco leaves contain from 2 to 8, and occasionally as high as 11 per cent. of nicotine. The alkaloid is present in all parts of the green plant, as well as in the dried leaves, and, according to Kissling (1882), also in tobacco-smoke. Instead of nicotine, H. Vohl and H. Eulenburg (1871), found chiefly *collidine*, with *pyridine*, *picoline*, and other bases of the same series in tobacco smoke, besides ammonia and traces of ethylamine; and, in passing the vapours through potassa solution, hydrocyanic, hydrosulphuric, acetic, formic, butyric, valerianic, carbolic, and probably other acids were retained. (*Stillé and Maisch.*)

According to Herr Dieser (*Archiv.* Mar. 31, 1889, p. 266) the acid tartrate of nicotine can be obtained as a well crystallized and definite salt. He prepares it by adding to pure nicotine a hot concentrated filtered alcoholic solution of tartaric acid, when the acid tartrate separates as a white syrup. After cooling, more of the tartaric acid solution is added, so long as it con-

tinues to produce a milky separation, and then the last trace of the salt remaining dissolved in the alcoholic liquor is precipitated by the addition of ether. The precipitate is dissolved in hot alcohol, the solution filtered, and ether added to promote the separation of the salt, when it is obtained in handsome crystalline tufts. Analysis of the salt indicated the formula $C^{10}H^{14}N^{2}(C^{4}H^{6})^{2}+2H^{2}O$; it therefore contains 32 per cent. of nicotine.

M. de Coninck (1889) made the interesting observation that in the oxidation of a ptomaine having the formula $C^{8}H^{11}N$ by means of a solution of potassium permanganate a pyridincarboxylic acid was obtained presenting the principal characters of nicotinic acid. Having since obtained the compound in a purer condition he is able now to state definitely (*Compt. Rend.*, cviii., 809) that this acid produced in the oxidation of a ptomaine is identical with nicotinic acid resulting from the oxidation of nicotine. (*Pharm. Jour., June* 8, 1889.)

Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.* 1890, 511) have discovered traces of mydriatic alkaloids in tobacco.

Toxicology.—The reports of the Chemical Examiners in India do not contain many cases of poisoning by this drug. Dr. Brown, *Punjab Poisons,* refers to a case of an infant, taken from its mother in the morning, and returned at night but soon died. Portions of tobacco were found in the stomach. In a second case, also reported by Dr. Brown, a female child of a woman who had left her husband was found dead; the stomach contained a quantity of green substance which proved to be portions of tobacco leaves; the brain and lungs were congested. In the Bengal Chemical Examiner's Report for 1884, tobacco was received in connection with three cases of alleged attempts at poisoning, in two of the cases *ganja* was mixed with the tobacco. In the Bombay Dispensary Reports (vol. ii., p. 4,) the injurious effects of tobacco as an emetic in a case of poisoning by opium is recorded. Dr. Lyon (*Med. Jurisprudence for India,* p. 291,) remarks:—"Death has resulted from swallowing tobacco, from administration of a

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decoction of tobacco as an enema, and from swallowing tobacco juice such as collects in pipes; and bad symptoms have been caused by the application of tobacco leaves to a wound, and even to the sound skin. Death has occurred from excessive smoking; it is doubtful, however, whether tobacco smoke contains nicotine; probably its poisonous effects are due to pyridine bases, developed during the combustion of the tobacco.

Commerce.—The average annual total exports of tobacco from India amount to 40 millions of pounds, valued at 11¼ lakhs of Rupees. It is exported from Bombay to Aden, Arabia, and the East Coast of Africa. Of manufactured tobacco the exports average 80,000 lbs., valued at about 24,000 Rupees; three-fourths of this quantity goes to Aden, and the remainder is distributed among twenty-eight different countries, and probably consists of small consignments of Indian cigars for the use of those who have acquired a taste for them in this country.

The annual production of tobacco in all countries has been estimated at about 3,000,000 tons. In former days the tobacco grown at Bhilsa in the Deccan was greatly esteemed, and it seems probable that tobacco was first cultivated in India at that place.

END OF THE SECOND VOLUME.

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HISTORY

OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN

MET WITH IN

BRITISH INDIA,

BY

WILLIAM DYMOCK,

BRIGADE-SURGEON, RETIRED,

LATE PRINCIPAL MEDICAL STOREKEEPER TO GOVERNMENT,

C. J. H. WARDEN,

SURGEON-MAJOR, BENGAL ARMY, PROFESSOR OF CHEMISTRY IN THE CALCUTTA MEDICAL COLLEGE,

AND

DAVID HOOPER,

QUINOLOGIST TO THE GOVERNMENT OF MADRAS, OOTACAMUND.

No. 3.

PART ~~VI~~. 5 & 6

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Dr. William Dymock.

In issuing the sixth part of the "Pharmacographia Indica," it is with much regret we have to announce the death of the senior author. This sad event, caused by influenza combined with cystitis, took place on the 30th April 1892, at his residence on Malabar Hill, Bombay, in the fifty-eighth year of his age. William Dymock belonged to the west of England, and was educated first at Bristol, then at Rugby, and afterwards at Oxford where he took a B.A. degree. After a course of medical studies, he became M.R.C.S. Eng., he then joined the Indian Medical Service, and was appointed to the Bombay Presidency in 1857. He saw active service during the Mutiny with the Kathiawar Field Force against the Wagheers, and was present at the capture of Dantal Hill. For two years he was attached to the Indian Navy, and visited the ports of the Persian Gulf and the East African Coast. In 1868 he served on the Committee for publishing the Pharmacopœia of India, and at the time he was Acting Resident Surgeon at the European General Hospital. After taking two years' furlough to England he was appointed in 1871 to be Principal of the Medical Store Department, Bombay, and in this capacity he laboured for nearly twenty years, until his retirement from the service on 30th April 1890. During this time he devoted all his energies to the study of materia medica and pharmacy. He largely increased the local manufacture of galenical preparations, and introduced modern and improved machinery in the Depôt laboratory. For his skilful and efficient management he was thanked by Government on three separate occasions. Dr. Dymock was proficient in Arabic, Persian, Sanskrit, Hindustani, Mahratti and Guzrati; he was familiar with Greek and Latin, and corresponded freely in French, German and Portuguese. He was a Fellow and Examiner of

the University of Bombay, and being an eminent linguist he was for many years a member of the Presidency Board for the examination of officers in Oriental languages. Bombay being the drug market of the East, he availed himself of the many opportunities of examining new and rare vegetable products, and having a good knowledge of botany, he was often able to identify the sources of the drugs. He was for some years Professor of Materia Medica in the Grant Medical College, and, as a teacher of this science, he was said not to have a rival in India.

Dr. Dymock's literary contributions to the *Pharmaceutical Journal* commenced in 1875 with a paper on "The Asafœtidas of the Bombay Market," this was followed by others on "Ammoniacum and Dorema Root," "Myrrh" and "Chaulmoogra Oil." In 1876, the well-known "Notes on Indian Drugs" first appeared, and were a feature of the Journal for the next four years. Specimens of these drugs were at the same time liberally supplied to the Pharmaceutical Society's Museum, and were sent to pharmacologists in England and the Continent for chemical investigation. In 1883 he brought out his "Vegetable Materia Medica of Western India," and this was amplified into a second edition only two years afterwards. The publication of a more comprehensive work on Indian Materia Medica, based on the same plan, was conceived in 1888, and next year the first part of the "Pharmacographia Indica" was issued. The greater responsibility of this work rested with him, and to it he gave his whole time until his fatal illness compelled him to cease from his labours a few days before he died. The manuscript of the sixth part, as far as he could prepare it, was written, and he compiled an index and an appendix which will be printed as soon as possible.

Dr. Dymock was one of the founders of the Anthropological Society of Bombay, and most actively supported the Society in the successive positions of member of the Council, President (1889), and General and Literary Secretary. The subject of his Presidential address was, "India as a field for Anthropological Research," and among his papers read at the meetings were

"Anthropogonic Trees," "On the Narcotics and Spices of the East," "The Flowers of the Hindu Poets," On the use of Turmeric in Hindu Ceremonial" and "On the use of Ganja and Bhang in the East." He also read papers before the Bombay Natural History Society and the Medical and Physical Society. He was honorary member of the Pharmaceutical and other learned societies. In 1887 he was awarded the Hanbury Gold Medal for his researches in the natural history and chemistry of drugs.

As a scientific investigator Dr. Dymock was thorough and conscientious; in his literary researches he was careful and painstaking; his disposition was kind and obliging. Although a man of varied and great talents he was of very retiring habits, and had very few social acquaintances. His subordinates regarded him as a father, and his correspondents in different parts of the world could always count upon a punctual and friendly reply to their enquiries. He was the greatest pharmacognoscist in this country, and many besides ourselves will mourn that such a useful career was so suddenly terminated.

C. J. H. WARDEN.

DAVID HOOPER.

CONTENTS OF VOL. III.

OPINIONS OF THE PRESS.

PHARMACOGRAPHIA INDICA. BY W. DYMOCK, C. J. H. WARDEN, AND DAVID HOOPER. PART IV.*

THE undertaking of the authors, in the preface of the first volume, to supplement the previous work published by Dr. Dymock with original investigation concerning the chemical composition and physiological action of Indian drugs, and to give toxicological statistics relating to the more important drugs, has been most conscientiously carried out. Consequently the present part, which completes the second volume, does not extend further than *Nicotiana Tabacum*, and the two volumes already published contain, as nearly as possible, twice as much matter as can be found in the 'Materia Medica of Western India,' up to the same point. Yet there still remains enough matter to be treated of to fill at least one more volume. Several new alkaloids have been discovered during the chemical examination to which some of the hitherto unexamined articles of materia medica have been subjected. Of these some have received a name, but of others only sufficient has been obtained to indicate their presence. Of those which have received a name may be mentioned—Bahmanine from red behen root; Nyctanthine from *Nyctanthes arbor tristis*; Jasminine from *Jasminum grandiflorum*; Salvadorine from *Salvadora persica*; Tylophorine from *Tylophora asthmatica*; Dæmine from *Dæmia extensa*; and Cuscutine from a species of Cuscuta. A new glucoside, to which the name of Dregein has been given, has been discovered in *Dregea volubilis*, an asclepiadaceous plant, and another, viz., gymnemic acid, in *Gymnema sylvestre*, a plant belonging to the same natural order.

Toxicological statistics form a marked feature in the present volume, the recorded cases of poisoning by *Plumbago rosea*, *Nerium odorum*, nux vomica and stramonium are given in a tabulated form. The last two appear to be the poisons most commonly in use for criminal purposes in India, for the tables extend over twenty-seven pages in the case of nux vomica and thirty-two in that of stramonium. In some instances interesting information is contri-

* London: Kegan Paul, Trench, Trübner and Co. 1891. Demy 8vo. pp. 305-644.

buted concerning plants that are common in this country, but of which the medicinal properties are almost unknown here. Thus *Anagallis arvensis* is said to be used in India as a fish poison and to kill leeches, and Orfila's statement to the effect that three drachms of an extract of the plant proved fatal to a dog, and M. Gronier's that the plant has a poisonous effect on hares is probably known to but few. *Sonchus oleraceus*, a common weed in this country, is mentioned as possessing active hydrogogue properties and being likely to be useful in ascites and hydrothorax. 'Pharmacographica Indica' thus forms a work, the usefulness of which is by no means confined to India. Being brought quite up to date, it will be found very valuable for purposes of reference on materia medica generally. Here and there throughout the volume interesting historical notes appear. In one of these, nepenthe is identified with henbane, Baron Hammer Purgstall's observation to this effect being quoted. "Bendj," the plural of which in Coptic is "nibendj," is without doubt the same plant as nepenthe, which has so much perplexed the commentators of Homer. Helen evidently brought the nepenthe from Egypt, and bendj is there still reputed to possess all the wonderful qualities which Homer attributes to it.

'Pharmacographia Indica,' like its namesake, is a work of reference that no student of materia medica can afford to be without, and which is not only valuable for the accuracy of its statements, but so far as its historical matter concerns cannot fail to prove most interesting to the student of Eastern languages, almost as much so as to the student of materia medica. The articles on poisons also should prove of great value to medical jurists, more particularly in India. Even the indefatigable searcher for new remedies will probably find scope for his energies in the long list of articles of materia medica as yet untried in this country. One of the most promising of these seems to be *Cosmostigma racemosum*, the root-bark of which, in doses of five grains, has been found by the authors to be "a most efficient cholagogue, without purgative effect, but restoring the natural colour of the stools after the usual remedies, mineral acids, podophyllum, euonymin, etc., had been abandoned in despair." With these few extracts, the reader may be left to dive for himself into this treasure house of Eastern materia medica. (*Pharmaceutical Journal*. July 11th, 1891.)

PHARMACOGRAPHIA INDICA; a History of the Principal Drugs of Vegetable Origin met with in British India. William Dymock,

C. J. H. Warden, David Hooper, authors. Part IV, pages 305—642, with Index to second volume.

In noticing preceding numbers of this work which have come to hand we have remarked that these authors are doing work for the materia medica of India, which for completeness, value and interest entitled it to compare with the work done by Flückiger and Hanbury in their famous Pharmacographia.

In the present number we have in the pages before us an account of about 100 drugs, which represent the following orders: Compositæ, Campanulaceæ, Ericaceæ, Plumbagineæ, Primulaceæ, Myrsineæ, Sapotaceæ, Ebenaceæ, Styraceæ, Oleaceæ, Salvadoraceæ, Apocynaceæ, Asclepiadeæ, Loganiaceæ, Gentianaceæ, Boragineæ, Convolvulaceæ, Solanaceæ.

The excellence of the contributions will receive the acknowledgment of all botanists, and the reliability of the material is assured from the names of the authors, hence the work may be regarded as having all the information at present known of the respective drugs mentioned. The contributions to science by these gentlemen entitle them to warm praise. (*Pharm. Record.* July 30th, 1891.)

Pharmacographia Indica.—A History of the principal Drugs of Vegetable Origin met with in India. By Wm. Dymock, Brigade-Surgeon, retired, etc.; C. J. H. Warden, Surgeon-Major, Bengal Army, etc.; and D. Hooper, Quinologist, etc. London: Kegan Paul, Trench, Trübner & Co. 1891.

Part IV. of this work, now before us, completes its second volume, and besides several orders of minor importance treats of the drugs procured from the orders of Sapotaceæ, Styraceæ, Apocynaceæ, Asclepiadeæ, Loganiaceæ, Gentianaceæ, Convolvulaceæ, and Solanaceæ. This part is characterized by all the excellencies upon which we have commented in connection with the preceding parts on their publication. Among the plants a number are noticed which are either indigenous or spontaneous in North America, like chicory, taraxacum, Sonchus oleraceus, Anagallis arvensis, dulcamara, stramonium, etc.; while others are cultivated either for ornament or other purposes, like Tagetes erecta, calendula, jessamine, oleander, Ipomæa Bona-nox, capsicum, tobacco and others. Far more numerous are those plants which are either indigenous to India or have become naturalized there from other tropical countries. (*American Journ. of Pharmacy.* August, 1891.)

Part VI is in the Press and will be ready at Midsummer.

An appendix, together with a copious Index of more than 100 double-column pages, is under preparation, and will be published as soon as the work is completed.

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PHARMACOGRAPHIA INDICA.

SCROPHULARINEÆ.

VERBASCUM THAPSUS, *Linn.*

Fig.—*Eng. Bot. viii., t.* 549; *Woodv. Med. Bot., t.* 125. Great Mullein (*Eng.*), Bouillon blanc, Molène (*Fr.*).

Hab.—Temperate Himalaya. Westwards to Britain. The root, leaves, and flowers.

Vernacular.—Phúlla, Ban-tambákú (*Hind.*).

History, Uses, &c.—The Hindi names for this plant are well chosen: Phúlla signifies "covered with flowers" and Ban-tambákú "wild tobacco." As far as we know it is not mentioned by Sanskrit medical writers. The Arabians describe it under the names of Adán-ed-dubb, "bear's-ear," and Mahizahraj, "fish poison"; it is also called Sikrán-el-hut, "fishes' hemlock," and in modern Arabic, Labidat-el-baida, "white felt plant," and Busir.

Mahizahreh and Busir are Persian names for Mullein, which is described very exactly by Haji Zein in the Ikhtiárát.

Mahometan physicians consider it to be hot and dry in the third degree, and prescribe it in gout and rheumatism in combination with aperients. They identify it with the φλόμος or φλομίς of the Greeks of which several kinds are described by Dioscorides as useful in diarrhœa and cough, and externally as an emollient; one kind, φλομίς λυχνῖτις, was used for making lamp wicks. The narcotic action of Mullein on fish appears to

be well known to the Arabs and Persians. According to Dr. Stewart, the roots are used in Northern India as a febrifuge.

In Europe Mullein has long had a reputation in the pulmonary diseases of cattle, on which account it bears the name of *Cow's Lungwort*. In Germany the plant is placed in granaries to drive away mice. The stalks covered with pitch were formerly used as flambeaux, from this practice the plant derived its names of *Cierge de Notre-Dame* and *Fleur de grand Chandelier* in France, and *High Taper* in England. The leaves and flowers are considered to be demulcent, diuretic, anodyne, and antispasmodic, and have long been in use in diarrhœa and pulmonary affections. An infusion of the flowers is used in France as a diuretic, and a cataplasm of the leaves as an emollient. The seeds are said to be narcotic, and to have been used in asthma and infantile convulsions. In 1883 Dr. F. J. B. Quinlan (*Brit. Med. Journ.*) drew attention to the popular use of the leaves boiled in milk as a remedy for phthisical cough and diarrhœa in Ireland, and stated that the plant was cultivated in gardens on rather an extensive scale. He claims for it weight-increasing and curative powers similar to those possessed by cod liver oil.

Description.—The root-leaves are from 6 to 18 inches in length, the cauline oblong, the upper ones being acuminate and sessile on the stem, more or less crenate, thickly covered with soft, whitish, stellate hairs. They have a mucilaginous somewhat bitter taste, and a disagreeable odour when fresh, which is lost on drying.

The flowers form a spike 6 to 10 inches in length, the corolla only is collected. It is from $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, bright yellow, 5-lobed, smooth above, and stellately tomentose beneath; attached to the tube are the stamens, of which the three upper are woolly, and the two lower longer and smooth. The taste is mucilaginous and somewhat bitter. The plant described by Haji Zein appears to be *V. Blattaria*, as he says that the flowers have a purple eye. The odour of the flowers has been compared with that of orris root.

The seeds are about $\frac{1}{25}$ of an inch in length, cone-shaped, finely pitted, very tough and difficult to powder, nearly inodorous, and have a somewhat acrid taste.

Chemical composition.—Morin (*Journ. Chim. Med. ii.*, p. 223) obtained from the flowers a yellow volatile oil, a fatty acid, free malic and phosphoric acids, malate and phosphate of lime, acetate of potash, uncrystallizable sugar, gum, chlorophyll, and a yellow resinous colouring matter.

Adolph Latin submitted the leaves to proximate analysis and found the constituents to be 0·80 per cent. of a crystalline wax, a trace of volatile oil, 0·78 per cent. of resin soluble in ether, 1·00 per cent. of resin insoluble in ether, but soluble in absolute alcohol, a small quantity of tannin, a bitter principle, sugar, mucilage, &c. The moisture in the air-dried sample amounted to 5·90 per cent., and the ash to 12·60 per cent. He concludes that the plant contains many of the usual constituents, and a bitter principle which may be prepared by exhausting the drug with alcohol, dissolving the alcoholic extract in water and agitating with ether or chloroform. Several trials failed to secure this substance in a crystalline condition. It was found to be soluble in water, ether, alcohol, and chloroform, and to possess a decidedly bitter taste. It responded to none of the tests for a glucoside or alkaloid. (*Am. Journ. Pharm.*, Feb. 1890. E. L. Janson (1890) found that petroleum ether and stronger ether used successively, extracted from the flowers about $\frac{1}{2}$ per cent. in each case. A decided change in the colour of the drug was noticed after the extraction with ether, which removed the yellow colour, leaving the residue of a dark green. The yellow colouring matter was either a part of, or else it was retained by, the resin dissolved by ether, and it was not found possible to separate it in the pure state. The drug after exhaustion with ether yielded 10·06 per cent. to absolute alcohol. A considerable portion of this alcoholic extract was soluble in water acidified with hydrochloric acid. When agitated with petroleum ether the acid solution yielded some colour to it, and this latter solvent on evaporation left a greenish-brown crystalline mass of a strong disagreeable odour and a sweet taste, which proved to be an easily decomposable glucoside. Another

crystalline extractive was obtained by making the above acid solution of the alcoholic extract alkaline and agitating with ether; while chloroform subsequently extracted a red-brown amorphous mass.

Both of these extractives reduced Fehling's solution, and many changes in colour were noticed, indicating that these substances take some part in the colouring matter of the flowers.

The drug was also found to contain 2·49 per cent. of mucilage, 11·76 per cent. of carbohydrate corresponding to dextrin, 5·48 per cent. of glucose, 1·29 per cent. of saccharose, 16·76 per cent. of moisture, 4·11 per cent. of ash, and 32·75 per cent. of cellulose and lignin. No reaction indicating tannin was obtained with iron salts, but an aqueous solution of the alcoholic extract yielded a slight precipitate with gelatin. The seeds yielded to petroleum ether 20·75 per cent. of a bright green fixed oil. The acrid principle was obtained from the alcoholic extract soluble in water by agitating with petroleum ether. The moisture was 10·86 per cent., and the ash 3·90 per cent. (*Amer. Journn. Pharm.*, Dec. 1890.)

Celsia coromandeliana, *Vahl.*, *Wight Ic.*, *t.* 1406, is an annual plant having the characters of Verbascum, which is common in many parts of India in the cold weather, usually appearing in fields or in the beds of rivers. It has much the same medicinal properties as *Verbascum Thapsus*, and has been brought to notice by Dr. B. M. Chatterjee as a sedative and astringent in diarrhœa. (*Phar. of Ind.*, p. 161.) The plant is slightly bitter and abounds in mucilage. The natives usually express the juice (*ang-ras*) and administer it in ounce-doses as a cooling medicine in fever, skin eruptions, dysentery, and such diseases as they consider to be due to heat of blood.

The plant is herbaceous, pubescent, and viscid; lower leaves lyrate, floral cordate, stem clasping; peduncles longer than the calyx; calycine segments ovate, slightly toothed, or oblong-lanceolate, entire; flowers largish, yellow; filaments bearded with purple hairs.

The Sanskrit name is Kuláhala; in Bengal it is known as Kukshima, and in the Deccan as Kutaki.

SCHWEINFURTHIA SPHÆROCARPA,
A. Braun.

Fig.—*Burm. Fl. Ind., t.* 39, *f.* 2; *Wight Ic., t.* 1459.

Hab.—Sind, Biluchistan, Afghanistan. The herb in fruit.

Vernacular.—Sannipát *(Ind. Bazars).*

History, Uses, &c.—In Hindu medical literature and in popular use, *San-nipáta* is a term which signifies a combined derangement of the three humors, Váta, Pitta, and Kafa (air, bile, and phlegm), which is supposed to produce *Sannipáta-jvara,* or fever with typhoid symptoms. The remedy for this condition is said to be a plant called Sannipáta-nud, "driving away sannipát," and Nepála-nimba, "Nepal Neem" or "Nepal bitter." At the present time the drug sold in the shops is *S. sphærocarpa,* but whether it is the original Nepal Neem is difficult to decide, as at present we do not even know whether this plant is found in Nepal. In typhoid conditions the drug is considered to act as a tonic, to promote diuresis, subdue fever, and remove the derangement of the humors. We are not aware of any experiments having been made with it by European physicians in India, though its near relationship with the Antirrhinums, which contain glucosides similar to those of Digitalis, would, we should have thought, have excited curiosity in regard to its physiological action.

Description.—The drug consists of the plant in fruit, broken up into small pieces. The fruit is a globular dry papery mucronate capsule, firmly attached to the calyx; the upper part of the capsule to which the placenta is attached is double; the placenta, which is large and oblong, is supported upon a thick peduncle, and occupies the centre of the capsule; to it are attached numerous straight 5-angled wedge-shaped seeds, which are packed closely together and fill the remaining space. The calyx is 5-partite, the upper segment very large and extending over the fruit like a hood. Leaves ovate, leathery, about 1 inch long with short blunt hairs; margin much lighter in colour than the rest of the leaf; seed straight, wedge-shaped, with six

prominent longitudinal ridges; testa tubercular, each tubercle minutely granular. The portions of stem, which are numerous, are woody and covered by a thin grey bark; the central pith is very large. The drug has a slightly bitter somewhat tea-like taste.

Chemical composition.—The powdered drug treated with ether yielded a dark olive-green extract, consisting of chlorophyll and uncrystallizable fatty matter. Subsequent percolation with alcohol removed a deep brown extract, from which cubical crystals of alkaline chlorides separated on evaporation. An aqueous solution of this extract had a saltish taste and gave distinct precipitates with alkaloidal tests. The alkaloid was removed by ether in an amorphous condition, and gave no well-marked colour reactions with the strong mineral acids. By continuing the exhaustion of the powdered drug with water, a deep reddish brown extract was obtained having a bitterish and nauseous taste, and containing saccharine and other matters which readily fermented. In order to ascertain if the drug contained a substance similar to digitalin, a fresh decoction of the powder was filtered and precipitated by tannin, the precipitate washed, mixed with an excess of alkali, and shaken with ether. The result was the separation of an alkaloid similar to that previously found. As more recent investigators prepare digitalin by exhausting with alcohol after treatment of the drug with water, this process was adopted with *Schweinfurthia.* The resinous matter collected had an acrid taste, but no principle could be obtained possessing the properties of digitalin, digitonin or digitoxin, to which, according to Schmiedeberg, the poisonous qualities of digitalis are due. Besides the alkaloid, which we consider to be the active principle, the drug yielded 18·6 per cent. of mineral matter.

Lindenbergia urticæfolia, *Lehm., Hook. Ic. Pl., t.* 875, is a common plant throughout India upon walls and banks; the juice is given in the Concan in chronic bronchitis, and mixed with that of the Coriander plant is applied to skin eruptions. It has a faint aromatic odour and a slightly bitter taste. The

Marathi name in the neighbourhood of Bombay is *Dhol.* Roxburgh, under the name of *Stemodia ruderalis,* gives the following description of it :—" *Root* ramous, seems perennial. *Stems* many, ascending, ramous, herbaceous, woody, somewhat viscous, the whole plant about 12 or 18 inches high. *Leaves* opposite, petioled, ovate, deeply serrate, soft, a little hairy; about an inch long. *Petioles* shorter than the leaves, channelled. *Stipules* none. *Flowers* axillary, subsessile, solitary, opposite, small, yellow. *Calyx* 10-furrowed, 5-toothed, permanent. *Corol* personate; *tube* the length of the calyx; both lips projecting, and shut; apex of the under lip broad, depending, 3-toothed, of the upper one very narrow, bifid; inside of both hairy, and beautifully marked with small purple dots. *Filaments* and *anthers* as in the genus. *Stigma* slightly 2-lobed." (*Flora Indica,* III., 94.)

LIMNOPHILA GRATIOLOIDES, *Br.*

Fig.—*Rheede, Hort. Mal. ix., t. 85, and xii., t. 36.*

Hab.—Throughout India, in swamps. The plant.

Vernacular.—Kuttra (*Hind.*), Karpur (*Beng.*), Ambuli (*Mar.*), Mánga-nári (*Mal.*).

History, Uses, &c.—This small aquatic plant, in Sanskrit Ambu-ja, " water born," and Ámra-gandhaka, having an odour of mangoes," is considered to be antiseptic by the Hindus, and its juice is rubbed over the body in pestilent fevers. Rheede notices its use for this purpose, and also internally in dysentery combined with ginger, cumin, and other aromatics. He also states that a liniment is made from the plant with cocoanut oil which is used in elephantiasis. Roxburgh, under the name of *Columnea balsamea,* describes the plant and notices its grateful odour and aromatic taste. The Bengal name signifies " camphor." The odour of the fresh plant is remarkably refreshing and agreeable and calls to mind that of camphor and oil of lemons.

L. gratissima, *Rheede, Hort. Mal. x.,* 6, has similar properties and bears the same vernacular names; it is also used

medicinally as a cooling medicine in fever, and given to women who are nursing when the milk is sour.

Description.—In its most common form a simple or branched plant 4—8 in. high, with whorled pinnatifid leaves $\frac{1}{4}$—$\frac{3}{4}$ in. long, which, in wetter places, appears to acquire a few emersed, opposite, entire leaves at the top of the stem, and numerous capillaceo-multifid ones at its base. The stems are stout or slender. Very small specimens from Rohilkund (Kuttra, Edgeworth) have very wiry simple stems 3 in. high, and capillary peduncles three times as long as the leaves; others have stout stems and peduncles, the latter shorter than the leaves. Calyx $\frac{1}{8}$—$\frac{1}{6}$ in. long, rarely larger. Corolla $\frac{1}{4}$ in., blue. (*Fl. Br. Ind.*)

HERPESTIS MONNIERA, *H. B. et K.*

Fig.—*Bot. Mag.*, *t.* 2557; *Roxb. Cor. Pl. ii.*, *t.* 178; *Rheede, Hort. Mal. x.*, *t.* 14. Gratiole de l'Inde (*Fr.*).

Hab.—Throughout India, in marshy ground. The herb.

Vernacular.—Sufed-chamni, Barambhi (*Hind.*), Dhop-chamni, Brihmi-sák (*Beng.*), Nir-brami, Bámba (*Mar.*), Nir-brami (*Tam.*), Sámbráni-aku, Sámbráni-chettu (*Tel.*).

History, Uses, &c.—Dutt states that this plant is the Brahmi of the native physicians of Calcutta, where it is considered to be a nervine tonic useful in insanity, epilepsy, fever, &c. It is certainly not the Brahmi of the Nighantas, but would appear to be the plant called Jala-brahmi or "Water Brahmi" by Sanskrit writers. Owing to a similarity in the names it has frequently been confounded with *Hydrocotyle asiatica*, which is the Brahmi or Brahmi-manduka of the Nighantas.

Ainslie says that in Southern India the *Gratiola Monniera* is considered diuretic and aperient, and useful in that sort of

stoppage of urine which is accompanied with obstinate costiveness. Roxburgh mentions the use of the juice mixed with petroleum as an external remedy in rheumatism. These accounts do not agree with the properties ascribed to Brahmi by Sanskrit writers. Rheede says of it:—"Ex frequenti hujus plantæ usu, vaccarum ubera lacte turgent; sit et decoctum ex illa in lacte vaccino et recenti butyro, contra delirium temporibus inunguendum; Pipere, Calamo aromatico, Myrobalanis et aqua oryzæ trita et assumpta, vocem reddit sonoram." In Pondicherry it is considered to be aphrodisiac, and in Ceylon, under the name of *Loonoo-wcela*, it is prescribed in fevers.

Description.—Stems several, annual, creeping, round, jointed, smooth, succulent; leaves opposite, sessile, obovate, wedge-shaped, or oblong, smooth, entire, obtuse, fleshy, dotted with minute spots; peduncles axillary, alternate, solitary, round, smooth, shorter than the leaves, one-flowered; flowers blue; bracts 2-awled, pressing on the calyx laterally; calyx 5-leaved, the exterior three leaflets large, oblong, the two interior small, linear, all are concave, smooth, pointed and permanent, corol campanulate, border 5-partite, nearly equal; anthers 2-cleft at the base, blue; stigma large, somewhat 2-lobed; capsule ovate, 2-celled, 2-valved; seeds very numerous. (*Roxb.*, *Flora Ind.*, I., p. 141.)

Chemical composition.—For the analysis the whole plant was used, dried at a low temperature and exhausted with 80 per cent. alcohol. The alcohol freed extractive was then agitated with petroleum ether; ether from an acid solution, and again with ether from an alkaline solution, and finally with chloroform from an alkaline solution. Operating in this manner, a trace of oily matter was obtained, soluble in alcohol with acid reaction; two resins, one easily soluble in ether, the other soluble with difficulty, but both soluble in alkaline solutions and reprecipitated by acids; an organic acid, and a tannin affording a green coloration with ferric chloride. An alkaloidal principal was also isolated, soluble in ether and in chloroform, and affording a cherry red coloration in the cold with Fröhde's reagent. No other reactions were noted.

PICRORHIZA KURROOA, *Benth.*

Fig.—*Royle Ill.*, *t.* 71.

Hab.—Alpine Himalaya; from Cashmere to Sikkim. The root.

Vernacular.—Katki, Kutki (*Hind.*, *Beng.*), Katuku-rogani (*Tam.*), Katuku-roni (*Tel.*), Bál-kadu (*Mar.*), Kutaki (*Guz.*).

History, Uses, &c.—This well-known drug is the Kutaki of Sanskrit writers, who speak of it as Dhanvantari-grastá, "the plant eaten by Dhanvantari," the physician of the gods, who was produced at the churning of the Ocean, holding a cup of *amrita* in his hands; he was the author of the Ayurveda. In the Nighantas it bears the following synonyms: Rohini, Katu-rohini, Vakrágra, Matsya-pitta, Matsya-vinna, Kánda-ruha, Krishna-bhedi, Dvijángika, Asoka-rohini, Sáku-ládani and Chakránga. It is described as digestive, bitter, pungent, dry, aperient, light and cold; and is recommended as a remedy for worms, asthma, bile, phlegm, and fever. Kutaki is a favorite remedy in bilious dyspepsia accompanied by fever, and is given daily in decoction, with liquorice, raisins, and Neem bark, half a tola (90 grains) of each, water 32 tolas, boiled down to one-fourth. In dyspepsia and dysentery it is combined with aromatics and is given in doses of ten to twenty grains.

It is considered to be specially indicated in those cases in which the secretions are scanty and the bowels costive, and is often prescribed for children suffering from worms, whence the Marathi name Bálakadu, "children's bitter."

Chakradatta states that about two drachms of the powdered root given with sugar and warm water act as a gentle aperient. Mahometan writers give Katki or Kutki as an Indian synonym for black Hellebore, and unmistakably describe the latter plant and its medicinal properties. This mistake has misled most European writers upon Indian drugs, but Ainslie, though he describes the drug in his article upon black Hellebore

(*Mat. Ind.*, I., p. 164), has the following remarks:—"I have given the names *Kadagoroganie* and *Kali-kootkie* as the Tamool and Dukhanie appellations of the black Hellebore, as the root procured in the Indian bazars is commonly said to be so; but I have great doubts of it, and I here offer a caution respecting it, as it by no means agrees in appearance with the black Hellebore of the European shops."

Royle (*Ill. i.*, p. 291) notices that the root of *P. Kurrooa* possesses much bitterness and is employed medicinally by the natives. Irvine (*Mat. Med.*, p. 58) mentions the use of Kutki as a tonic, but owing to a general impression that the bazar drug was Hellebore root, European medical men appear to have generally avoided making experiments with it. Mr. Moodin Sheriff was the first modern writer to clearly demonstrate that the bazar drug has no dangerous properties, but is a valuable tonic and antiperiodic. He also identified it with the *P. Kurrooa* of Royle, an identification which we are now able to confirm through the kindness of Mr. J. F. Duthie who has supplied us with a specimen of the plant collected in Kumaon. As regards the medicinal properties of the drug, the accounts given by Sanskrit writers appear to be correct. Mr. M. Sheriff speaks favourably of it as a powerful bitter tonic and antiperiodic. Other medical men in India have expressed a similar opinion, and we can state from personal observation that it is used successfully as an antiperiodic in native practice; its slight laxative action is rather beneficial than otherwise. The dose as a tonic is from 10 to 20 grains, as an antiperiodic from 40 to 50 grains; it is best administered in combination with aromatics.

Description.—The drug consists of a rhizome, generally about the size of a goose-quill, but often no larger than a crow-quill, the lower portion of which is covered by a shrivelled, greyish-brown, corky bark, and marked by prominent scars, the remains of rootlets; towards the upper end it becomes larger (¼ inch in diameter), and is thickly set with dark greyish-brown scales, and terminates in a scaly leaf-bud or stem. The rhizome is generally broken into short pieces, from 1 to 2

inches long; the fracture is short, the root very fragile and light, and black internally; it has no odour, and a very bitter taste.

Microscopic structure.—The corky bark is made up of numerous rows of empty brick-shaped cells; within this is a cellular parenchyma of oblong brown cells, containing a little granular matter; next a dark brown line composed of wood cells, forming the boundary of the inner column of the root; within this several very large bundles of dotted vessels arranged so as to form a broken ring, which surrounds a central cellular parenchyma.

Chemical composition.—A proximate analysis of this drug showed the following percentage composition:—

Wax	1·06
Bitter principle (Picrorhizin)	14·96
Picrorhizetin	3·85
Organic acid ppt. by lead	3·54
Glucose	11·53
Cathartic acid, &c. (water extract)	9·33
Substances dissolved by NaHO	7·62
Arabin bodies from crude fibre	14·56
Fibre	24·00
Moisture	5·73
Ash	3·82

The bitter principle is a glucoside *Picrorhizin*, freely soluble in water and alcohol, but almost insoluble in pure ether. It is acid in reaction, is not precipitated from solution by lead salts or tannin, but is absorbed by animal charcoal together with any colouring matter that is present. It is best obtained by exhausting the powdered drug with crude ether, and is left, after the evaporation of the ether, in brown resinoid drops which form ramified crystals on standing. It is difficult to obtain the picrorhizin in a crystalline condition after heating or after solution in water. Any wax removed by the crude ether can be separated from the dry extract by petroleum spirit, which has no solvent action on the bitter principle. The

picrorhizin is decomposed by hydrolizing it with a boiling 1 per cent. solution of hydrochloric acid for three hours, and a decomposition product, which we have named *Picrorhizetin*, is formed together with glucose. In obtaining 0·7 gram of picrorhizetin ·368 gram separated during the first hour, ·219 gram in the second hour, ·113 gram in the third hour, and none in the fourth. Weighed quantities of the picrorhizin, after drying at 100°C., afforded, on hydrolysis, 62·48 and 62·79 per cent. of picrorhizetin, as the result of two experiments. The glucose obtained from the decomposition was inactive towards polarized light. An infusion or tincture of the root boiled with diluted acid gradually loses its bitterness, and a large increase in the sugar is detected by Fehling's solution. Picrorhizetin is a red-brown, brittle, resinous, tasteless body soluble in aqueous alkalies. It is insoluble in water, and its solution in alcohol is precipitated by ether. By heating with strong sulphuric acid or when being burnt it evolves an odour of benzoin.

The wax after bleaching, and purifying by recrystallization from hot alcohol, had a melting point of 51°C. The organic acid separated by lead was red-coloured and gave a greenish colour with ferric salts. No tannic acid was present. Some picrorhizetin was naturally formed in the drug, and existed in a much smaller proportion in the freshly dried rhizome. After removing the bitter principle by continued percolation with alcohol, the marc was dried and exhausted with water, the dark red-brown solution was evaporated to dryness, and ·2 gram of the residue was found to act as a decided purge. The aqueous extract treated with four volumes of alcohol afforded precipitates containing 14·5 and 15·3 per cent. of mineral matter, and with six volumes a precipitate was obtained with 10·8 per cent. of ash. We rely upon the physiological action of this extract in considering cathartic acid to be a constituent.

Commerce.—Value, Rs. 9 per maund of 37½ lbs. Kumaon annually exports about five tons of this drug.

Plants of minor importance belonging to this order, which have a certain amount of medicinal reputation, are:—

Torenia asiatica, *Linn., Rheede, Hort. Mal. ix., t.* 53, the juice of which is given on the Malabar Coast for gonorrhœa.

Vandellia erecta, *Benth., Rheede, Hort. Mal. ix., t.* 57, called *Vaka-pushpi,* or "crane flower," in Marathi, is also used in a ghrita as a remedy for gonorrhœa, and the juice is given to children who pass green-coloured stools. **V. pedunculata,** *Benth. Griff. Ic. Pl. As., t.* 418, *f.* 2, in Marathi *Gadagvel,* is considered to have similar properties.

Veronica Beccabunga, *Linn. Reichb. Ic. Fl. Germ., t.* 1701, is used in Northern India under the name of *Tezak,* "cress," as a diuretic and antiscorbutic. It is the Bachbunge of the Germans, Cressonée of the French, and Brooklime of the English. **V. Anagallis,** *Linn. Reichb. Ic. Fl. Germ., t.* 1762, which has similar properties, takes its place in other parts of India.

Sopubia delphinifolia, *G. Don, Roxb. Cor. Pl. i., t.* 90, is an elegant annual, common in wet fields in the rainy season. The juice is applied by field labourers to their feet to heal sores caused by exposure to wet; it is astringent and stains the skin yellow at first but afterwards black. The plant was formerly named *Gerardia,* after John Gerarde, our old English botanist, and author of the "Herbal," published in 1597.

Pedicularis pectinata, *Wall.,* and several other species are used in Northern India under the name of *Mishran* on account of their astringent and hæmostatic properties.

BIGNONIACEÆ.

OROXYLUM INDICUM, *Vent.*

Fig.—*Wight Ic., t.* 1337; *Bureau Monogr. Bign., t.* 9; *Rheede, Hort. Mal. i., t.* 43.

Hab.—Throughout India. The root-bark.

Vernacular.—Arlu, Phalphala, Sona (*Hind.*), Nasona, Sona (*Beng.*), Mulin, Tálpalang, Miringa (*Punj.*), Tetu, Jagdala (*Mar.*), Tetu (*Guz.*), Vanga adanthay (*Tam.*), Tigdu-mara, Sone-patta (*Can.*), Pamania, Dundillam (*Tel.*), Peiani (*Mal.*).

History, Uses, &c.—This is a small tree, remarkable for its terminal spikes of large fleshy lurid flowers, which appear at the commencement of the rainy season, and are followed by very large, retrofracted, transversely compressed, somewhat curved pods, with the convexity upwards. The seeds are numerous, membranaceous, surrounded with a large, delicate, membranaceous wing. The leaves are supra-decompound, and from four to six feet long. The root-bark is of considerable importance in Hindu medicine, as it is an ingredient of the Dasamula (see *Tribulus terrestris*); it is considered to be astringent, tonic, and useful in diarrhœa and dysentery. Sarangadhara recommends the juice of Syonaka expressed from the roasted bark in combination with Mocharas (see *Bombax malabaricum*) as a remedy in diarrhœa and dysentery. He also says that the root-bark boiled in Sesamum oil is a good application in otorrhœa. In the Nighantas the tree bears many synonyms, amongst which may be mentioned Prathu-simbih, "having broad pods," Súka-nasa, "having a nose like a parrot's beak," in allusion to the flower buds, Aralu, and Bhalluka-priya, "dear to bears." It is described as digestive, appetising, bitter, astringent, cold, pungent; a remedy for wind, phlegm, bile, and cough. The bark is much used by the agricultural classes as an application to the sore-backs of draught cattle. It is ground to a paste with water and an equal proportion of turmeric, and rubbed on the part. Rheede notices the use of the bark as an

application to wounds, fractures, &c., and of the root in decoction in dropsy.

Dr. B. Evers states that the Gonds call the tree *Jaimangal,* and that they employ a decoction of the bark as a discutient application to rheumatic swellings. He says:—"I have made a trial of the powder and an infusion of the bark, and have found it to be most powerfully diaphoretic; the drug has slight anodyne properties; also a bath, prepared with the bark, I have frequently employed in rheumatism. Twenty-eight cases of acute rheumatism were treated with this drug, and in all the results have been most satisfactory. The dose of the powder is from 5 to 15 grains, thrice daily; of the infusion (1 ounce of bark to 10 ounces of boiling water) an ounce three times a day. Combined with opium it forms a much more powerful sudorific than the compound powder of ipecacuanha. The drug does not possess any febrifuge properties."—*Indian Medical Gazette,* February and March, 1875.

Description.—The bark of the root is brown externally, yellow internally, thick, breaking with a short fracture. That of the stem is soft and spongy externally, and of a pale brown colour, furrowed longitudinally; the internal surface is fibrous and greenish yellow. The minute structure does not call for remark, but upon placing a section of the fresh bark under the microscope in a little water the whole field is seen to be filled with delicate needle-shaped crystals which have escaped from the cut cells of the parenchyma; in entire cells the crystals, which are of an inorganic nature, can be seen *in situ.* The bark is faintly bitter and a little acrid; it has no particular odour.

Chemical composition.—The bark has been examined by W. A. H. Naylor and E. M. Chaplin with the following results:—

A. One pound of the bark reduced to fine powder was percolated to exhaustion with cold petroleum ether. The ether was distilled off, and the residue, which weighed about 1·8 gram, possessed the characters of a soft greenish-brown fat, having an acid reaction and a slightly acrid taste. It was treated successively with ether and proof spirit; the former removed

vegetable wax, which was subsequently identified as such after re-solution in limited quantities of ether and separation therefrom. The latter on evaporation gave a brownish-yellow residue small in quantity and crystalline. When further purified by extraction with ether and the ethereal residue by benzol it was golden yellow, unctuous to the touch, and pronouncedly acrid. Under the microscope it presented the appearance of long, wavy, branching crystals, which dissolved readily in alcohol, chloroform ether, petroleum ether, and benzol.

B. The marc was next percolated with cold ether. After distilling off the greater portion of the ether, and allowing the remainder to evaporate spontaneously, a yellow mass studded with minute interlacing crystals was obtained, which when air-dried weighed about 4 grams. This product was treated with boiling proof spirit and filtered while hot; on cooling small yellow crystals fell out of solution. When quite cold the crop of crystals was collected and subjected to the action of boiling petroleum ether until freed from every trace of fat. It was then cystallized from boiling proof spirit until it had a constant melting point, and was no longer contaminated with uncrystallizable matter. The resulting crystals were dried under the receiver of an air-pump, and when constant weighed 0·9 gram. They were of a lemon yellow colour, about ⅛ inch in length, and melted at 228·5°—229° C. Alcohol, ether, glacial acetic acid, and hot benzol dissolved them readily, but they were practically insoluble in water hot or cold. The following reactions in connection with this interesting body have been noted, of which the most striking is its behaviour with the caustic alkalies. A minute quantity brought into contact with one drop of a weak solution of sodium potassium or ammonium hydrates causes it to assume immediately a cherry-red colour, which quickly passes into brick-red and olive-green.

Owing to the insolubility of the crystals in water a proof spirit solution was used in applying the following tests:—

1. A solution of silver nitrate in proof spirit produced a bluish-black colour immediately, and after the liquid had stood

for a few minutes black particles of reduced silver were precipitated.

2. A solution of neutral acetate of lead in proof spirit gave a light-red bulky precipitate insoluble in boiling acetic acid.

3. Lime water imparted an orange colour, which quickly changed to olive-green, followed by a precipitate of the same colour.

4. An aqueous solution of sulphate of copper gave a golden yellow colour, quickly followed by a dirty brown precipitate, the supernatant liquid being distinctly greenish.

5. Solution of ferric chloride (acid) produced a brownish-red colour, which, in a few minutes, turned smoke-colour.

6. Solution of subacetate of lead gave a golden yellow precipitate.

7. An aqueous solution of mercuric chloride produced a white precipitate.

8. An aqueous solution of permanganate of potash, acidified with sulphuric acid, was *instantly* decolorized.

9. A solution of the crystals in proof spirit did not reduce Fehling.

The authors say:—"We have attempted to hydrolyse this body, by subjecting a strong alcoholic solution to the prolonged action of 10 per cent. solution of sulphuric acid at a boiling temperature, but without success.

"We have also inquired into its nature and centesimal composition, but the results so far obtained are not sufficiently conclusive to be incorporated in this paper. We hope to be able to publish shortly a supplementary note dealing with points in process of investigation. Meanwhile, we propose that this interesting principle be designated *Oroxylin.*"

C. The marc left after exhaustion with petroleum spirit and ether was percolated with cold absolute alcohol. The residue resulting from the distillation of the spirit was treated with cold proof spirit, which took up the greater part of it. The insoluble portion dissolved readily in boiling proof spirit, and, on

examination, proved to be largely composed of the yellow crystalline body oroxylin. The cold proof spirit solution of the alcoholic residue was evaporated to dryness and the extract treated with water and filtered. The filtrate was treated successively with neutral and basic acetate of lead, and the precipitates after washing were suspended in water, decomposed by a current of sulphuretted hydrogen and the resultant plumbic sulphide removed by filtration. Sulphuretted hydrogen was also passed through the filtrate from the basic or plumbic acetate and the precipitated lead sulphide removed by filtration.

The three liquids thus obtained, which for convenience may be denominated i., ii., iii., were then evaporated down and the respective residues examined.

(i.) It was dissolved in the smallest quantity possible of cold water and diluted with many times its volume of alcohol. After setting aside for twenty-four hours a precipitate fell, giving the general characters of parapectin. The supernatant liquid on evaporation left a scaly residue, astringent to the taste, and perfectly soluble in water. Its aqueous solution reduced Fehling and gave a copious bluish black precipitate with ferric chloride. Lime-water produced a bright golden-yellow colour, followed by a reddish-brown precipitate. From the tannins proper it differed in that it was not precipitated by solution of gelatine.

(ii.) This residue apparently consisted of pectin intermixed with small portions of No. iii.

(iii.) This was a dark uncrystallizable treacly-looking residue, which imparted to the palate a feeble sensation of sweetness. It was very soluble in water and reduced Fehling's solution abundantly. A strong aqueous solution was precipitated by absolute alcohol.

D. The marc from the alcoholic extraction was finally percolated to exhaustion with cold water. The liquor was evaporated down and the extract obtained taken up with hot water. A considerable amount of albuminous matter, which remained insoluble, was removed by filtration. The filtrate was treated

successively with neutral and subacetate of lead and the precipitates decomposed in the same manner as described under C. The three liquids obtained, i., ii., iii., were evaporated down.

(i.) This residue was the smallest of the three. After standing for a considerable time some crystals were deposited, which on examination proved to be citric acid.

(ii.) Nothing of a crystalline nature was found in this residue. It appeared to consist chiefly of extractive matter.

(iii.) This residue after treatment with alcohol had the same characters and possessed the same properties as C. iii. It was not further examined.

The result of our examination of this bark may be summarized by stating the different principles which we have found—(1) crystalline fat; (2) wax; (3) acrid principle; (4) oroxylin; (5) chlorophyll; (6) pectinous substances; (7) Fehling-reducing principle; (8) astringent principle; (9) citric acid; (10) extractive matter.—*Pharm. Journ.*, Sept. 27, 1890.

STEREOSPERMUM SUAVEOLENS, *DC.*

Fig.—*Wight Ic., t.* 1342.

Hab.—Throughout the moister parts of India. The root-bark and flowers.

Vernacular.—Pád, Paral, Káshta-pátali (*Hind.*), Parul (*Beng.*), Kálgori, Pádri (*Mar.*), Pádri (*Tam.*), Kálgoru, Pádari (*Tel.*), Húdai, Pádri-gida (*Can.*), Pádri, Paudan (*Guz.*). The flowers, Madana-kama-pu (*South India*).

History, Uses, &c.—This tree is the Pátalá or Pátali of Sanskrit writers, the flowers of which are said by the poets to so intoxicate the bee that he is unable to distinguish one flower from another. The tree is sacred to Durga, the wife of Siva. In the Nighantas it bears among other synonyms those of Káma-duti "Cupid's messenger," Madhu-duti "messenger of spring," Sthâli, Ambu-vásini, and Tamra-pushpa "red flowered." Pátala also signifies "light red" or "rose-coloured." It

is described as cooling, sweet, diuretic, and tonic, and is recommended in dyspepsia, dropsy, cough, and heat of blood.

P. S. Mootoosawmy says that in Tanjore the flowers are taken in the form of a confection as an aphrodisiac. The flowers pounded with honey are said to stop troublesome hiccough, and the ashes of the bark are used in preparing alkaline ley and caustic pastes. The bark is in use throughout India from its being one of the ingredients in the Dasamula or "ten barks." (See *Tribulus terrestris.*) In parts of India where this tree is not found, various substitutes are allowed to be used. In Malabar and in the Concan *S. chelonoides*, DC., is used as Pádri. (See *Rheede, Hort. Mal. vi., t.* 25 ; *Ainslie, Mat. Ind. ii.*, p. 272.)

Description.—Trunk tolerably erect, though not straight. Bark ash-coloured, and somewhat scabrous. Leaves opposite, pinnate, with an odd one, from 12 to 24 inches long. Leaflets opposite, from two to four pairs, oval, with long bluntish, narrow points slightly serrate, having both sides downy while young, and when full grown not downy and feeling harsh ; the exterior pair and odd one about six inches long, by three or four broad; the inferior pair, or pairs, smaller. Petioles swelled at the base, roundish, when old scabrous. Panicles terminal, composed of a few spreading branchlets; the first and second pairs thereof opposite; the superior dichotomous, with a solitary pedicelled flower in the forks; all are downy, and somewhat viscid. Flowers large, of a dark, dull crimson colour, exquisitely fragrant. Calyx campanulate. Border 4-cleft; upper divisions with two minute points, outside a little villous. Corol, throat ample, woolly, convex above, flat and plaited beneath. Border, the upper divisions shorter, erect; the three inferior ones longer and projecting, with the margins of all much curled. Filaments 4, fertile, and between them a small sterile one. Anthers twin. Germ oblong, elevated on a glandular receptacle. Stigma 2-lobed. (*Roxburgh.*) Sir W. Jones gives the following description of the flowers:—Corolla externally light purple above, brownish purple below, hairy at its convexity ; internally dark yellow below, amethystine above, exquisitely fragrant; preferred

by bees to all other flowers, and compared by the poets to the quiver of Kamadeva (the Indian Cupid).

Chemical composition.—An infusion of the dried flowers contained saccharine, mucilaginous and albuminous matters, but no alkaloid could be detected in either the aqueous or alcoholic extract. Ether removed a small quantity of a wax-like solid from the powdered corollas.

STEREOSPERMUM CHELONOIDES, *DC.*

Fig.—*Wight Ic.*, *t.* 1341; *Bedd. Fl. Sylv.*, *t.* 72; *Rheede, Hort. Mal. vi.*, 26. Favas da Cobre (*Port.*), Adderbonen (*Dutch*).

Hab.—Throughout the moister parts of India. The flowers, leaves, and root.

Vernacular.—Páder, Pádri (*Hind.*), Dharmara (*Beng.*), Pádal (*Mar.*), Pádri (*Tam.*, *Mal.*), Tagada (*Tel.*), Padrigida (*Can.*).

History, Uses, &c.—In the Concan and Malabar, where *S. suaveolens* is not found, this tree is used as the Pátalá of the Nighantas. Rheede says of it:—"Viscerum rigorem intolerabilem dispellit foliorum decoctum. Limonis hujusque commixti succi medentur maniæ. Corticis vero succus, cum fructu Peræ subactus, immodicum inhibet fluxum menstruum. Radicis cutis cum Calamo aromatico, zinzibere contrita, foliorumque Padri succo admixta exhibetur morsis à putrefaciente colubro, Malabaribus *Polenga* dicto." Ainslie (ii., 272) says:—"This pleasant tasted root, as well as the fragrant flowers of the tree, the Vytians prescribe in infusion as a cooling drink in fevers."

The tender fruit and flowers of *S. chelonoides* are used as vegetables by the natives of Western India.

Description.—Trunk straight, of a great height and thickness. Bark thick, scabrous, brown. Branches very numerous, the inferior horizontal above, gradually becoming more and

more erect to the top; leaves opposite, pinnate, with an odd one, about twenty inches long; leaflets opposite, short petioled, generally four pair, the inferior smallest, obliquely oval, pointed, sometimes slightly notched about the margins, when young downy, afterwards smooth, about 4 inches long by two broad; petioles about 9 inches long, channelled, smooth; stipules none; panicles terminal, the larger ramifications decussate, the smaller or terminal 2-forked, with a sessile flower in the cleft; peduncles and pedicels round, covered with oblong grey scabrous specks; bracts small, caducous; flowers pretty large, yellow, very fragrant; calyx 5-notched; nectary, a yellow fleshy ring surrounding the base of the germ; filaments, there is a fifth sterile one between the lower pair; anthers double; stigma 2-cleft; silique very long, slender, twisted; receptacle of the seeds spongy, white, with alternate notches on the sides for the seeds to lodge in. (*Roxb., Fl. Ind.*, III., 106.)

STEREOSPERMUM XYLOCARPUM, *Wight.*

Fig.—*Wight Ic., t.* 1335-6; *Bedd. Fl. Sylv., t.* 70.

Hab.—Deccan Peninsula. The wood and tar.

Vernacular.—Kharsing (*Mar.*), Ghansing (*Can.*).

History, Uses, &c.—This tree is a native of the forests of Western India from Khandesh to Malabar. It was introduced by Dr. Andrew Berry into the Botanic Garden at Calcutta, and is minutely described by Roxburgh.

The natives by a rough process of the same nature as that by which tar is obtained from Pine wood, extract from the wood a thick fluid of the colour and consistence of Stockholm tar, which they use as a remedy for scaly eruptions on the skin. Two globular earthen pots are used, the upper contains the wood in small pieces; it has a perforated bottom and is fitted with a cover, and is luted to the mouth of the lower pot. Cowdung cakes are then piled up round the two pots and set fire to. Dr. Gibson appears to have been the first to draw attention to the use of this substance by the natives. From some trials

which we have made with it, we conclude that its properties are similar to those of Pine tar.

Description.—The wood is hard, but easily split; when sawn across it presents a yellow resinous surface; sections examined with the microscope show that the yellow colour is due to a solid resinous deposit in the pitted vascular system. The tar has exactly the odour, colour, and consistence of Stockholm tar.

Heterophragma Roxburghii, *DC., Roxb. Cor. Pl. ii., t.* 145, yields a similar product. Its vernacular names are Waras (*Mar.*), Baro-kala-goru (*Tam.*), Bondagu (*Tel.*).

Dolichandrone Rheedii, *Seem.*, is the *Nir-pongelion* of Rheede (vi., 29), who states that the seeds with ginger and Pavetta root are administered in spasmodic affections, and that in Malabar a decoction of the bark is used for preserving fishing nets. He gives *Cornos das Diabos* as the Portuguese name and *Bocks hoorn* as the Dutch.

Dolichandrone falcata, *Seem. Bedd. Fl. Sylv., t.* 71, a native of Oudh, Rajputana, Central and South India, has the reputation of being used to procure abortion, and the bark is, it is stated, used as a fish poison.

Dr. Lyon, Chemical Analyser to the Government of Bombay, found, however, no ill effects to follow the administration of a considerable quantity of a decoction of the bark to a small dog. (*Med. Juris. for India*, p. 216.) It is possible that the woody capsules, which are about a foot in length by ⅜ of an inch in diameter, and somewhat curved, may be used as abortion sticks.

CRESCENTIA CUJETE, *Linn.*

Fig.—*Jacq. Amb., t.* 111; *Plumb. Gen., t.* 109. Calabash tree (*Eng.*), Calebassier (*Fr.*).

Hab.—South America. Cultivated in India. The fruit.

Vernacular.—Kalabash (*Africa*).

History, Uses, &c.—The Calabash tree introduced from South America is now pretty well known in India, and latterly we have observed the fruit being offered for sale by the herbalists for use as a pectoral in the form of a poultice of the pulp applied to the chest. In the West Indies a syrup is made from the pulp, which is much used in dysentery and as a pectoral. The tree has oblong cuneate, often obovate, entire, shining leaves, and flowers variegated with green, purple, red and yellow. The fruit is large, gourd-like and green; it varies much in size, being from 2 inches to a foot in diameter.

Dr. Peckolt, of Rio Janeiro, states that an alcoholic extract of the not quite ripe fruit in doses of 0·10 gram. acts as a mild aperient, and that 0·5 gram. proves strongly drastic, without griping or ill effects. As an application against erysipelas, the fresh pulp is boiled with water until it forms a black paste, to which vinegar is added and the whole boiled together and spread upon linen.

Corre and Lejanne state that in Western Africa the leaves, along with those of *Adansonia digitata*, are boiled and eaten, and the seeds are eaten roasted. The pulp of the fruit macerated in water is considered to be depurative, cooling, and febrifuge; it is applied to the head in headache caused by insolation and to burns: roasted in ashes it is mildly purgative and diuretic, according to P. Labat; in the Antilles, Chevalier has recommended it in dropsies.

Description.—Fruit ovoid or nearly round, with a hard, green, woody shell; very variable in size. It is filled with a white, slightly acid pulp, in which are contained the flattened, somewhat cordiform seeds.

Chemical composition.—A chemical examination of the fresh fruit pulp yielded a new organic acid, crystallizing in plates, to which the name '*crescentic acid*' has been given. It was obtained by exhausting with water an alcoholic extract of the pulp, treating the aqueous solution with lead acetate, suspending the lead precipitate in water and decomposing and

removing the lead, then evaporating to a syrupy consistence and leaving it to crystallize in a cool place. Besides crescentic acid, there were found tartaric, citric and tannic acids, two resins, a bitter and an aromatic extractive substance, and a colouring matter that appeared to resemble indigo. (*Peckolt, Pharm. Rundschau,* Aug. 1884; *Year Book of Pharm.*, 1885, p. 168.)

PEDALINEÆ.

SESAMUM INDICUM, *DC.*

Fig.—*Wight Ill., t.* 163; *Bot. Mag., t.* 1688; *Bentl. and Trim., t.* 198. Sesame (*Eng.*), Sésame de l'Inde (*Fr.*).

Hab.—Throughout the warmer parts of India, cultivated. The leaves, seeds, and oil.

Vernacular.—Til (*Hind., Beng.*), Ellu (*Tam.*), Nuvvulu (*Tel.*), Ellu, Kárellu (*Mal.*), Yellu (*Can.*), Mothetil (*Mar.*), Tal (*Guz.*).

History, Uses, &c.—In Hindu mythology Sesamum seed is symbolic of immortality. According to the "Brahma-purana," Tila was created by Yama, the "king of death," after prolonged penance. The Grihyasutra of Ásvaláyana directs that in funeral ceremonies in honour of the dead, Sesamum seeds be placed in the three sacrificial vessels containing Kusa grass and holy water, with the following prayer: "O Tila, sacred to Soma, created by the gods during the Gosava (the cow-sacrifice, not now permitted), used by the ancients in sacrifice, gladden the dead, these worlds and us!" Sesamum seeds with rice and honey are used in preparing the funereal cakes called Pindas, which are offered to the Manes in the Śraddh ceremony by the Sapindas "or relations" of the deceased.

On certain festivals six acts are performed with Sesamum seeds, as an expiatory ceremony of great efficacy, by which the

Hindus hope to obtain delivery from sin, poverty, and other evils, and secure a place in Indra's heaven. These acts are, *tilodvarti*, "bathing in water containing the seeds"; *tilasnayi*, "anointing the body with the pounded seeds"; *tilahomi*, "making a burnt offering of the seeds"; *tilaprada*, "offering the seeds to the dead"; *tilabhuj*, "eating the seeds"; and *tilavápi*, "throwing out the seeds." Water and Sesamum seeds are offered to the Manes of the deceased. In the first act of Sakuntala this practice (called *Til-anjli*) is alluded to by the anchorite's daughter in love with King Dushyanta, when she tells her companions that if they do not give their assistance, they will soon have to offer her water and Sesamum seeds. (*De Gubernatis.*) In proverbial language a grain of Sesamum signifies the least quantity of anything—*Til chor so bajjar chor*, "who steals a grain will steal a sack"; *Til til ka hisab*, "to exact the uttermost farthing."

A worthless person is compared to wild Sesamum (Jartila, *Sans.*) which yields no oil—*In tilon men tel nahin*, "there is no good in him." Dutt remarks:—"The word Taila, the Sanskrit for oil, is derived from Tila; it would therefore seem that Sesamum oil was one of the first, if not the first oil manufactured from oil-seeds by the ancient Hindus. The Bhávaprakása describes three varieties of Til seeds, namely, black, white, and red. Of these the black is regarded as the best suited for medicinal use; it yields also the largest quantity of oil. White Til is of intermediate quality. Til of red or other colours is said to be inferior and unfit for medicinal use. Sesamum seeds are used as an article of diet, being made into confectionery with sugar or ground into meal. Sesamum oil forms the basis of most of the fragrant or scented oils used by the natives for inunction before bathing, and of the medicated oils prepared with various vegetable drugs. It is preferred for these purposes from the circumstance of its being little liable to turn rancid or thick, and from its possessing no strong taste or odour of its own. Sesamum seeds are considered emollient, nourishing, tonic, diuretic, and lactagogue. They are said to be especially serviceable in piles, by regulating the bowels and removing constipation. A

poultice made of the seeds is applied to ulcers. Both the seeds and the oil are used as demulcents in dysentery and urinary diseases in combination with other medicines of their class." (*Mat. Med. of the Hindus*, p. 216.)

Mahometan writers describe the seed under the Arabic name of Simsim. In Africa it is called Juljulán,* and in Persia Kunjad. The Mahometan bakers always sprinkle the seeds upon their bread, the sweetmeat-makers mix them with their sweets. The following Delhi street-cry indicates the properties attributed to them by the latter class of people:—

"Til, tikhur, tisi, dána,
Ghi, shakkar meṅ sána,
Kháë buddha, hoe javána."

"Sesamum, tikhur, and linseed,
Butter and sugar, poppy seed,
Old men it makes quite young with speed." (*Fallon.*)

The oil, which is called in Arabic Duhn-el-hal, is used for the same purpose as olive oil is in Europe. Sesamum is considered fattening, emollient, and laxative. In decoction it is said to be emmenagogue; the same preparation sweetened with sugar is prescribed in cough; a compound decoction with linseed is used as an aphrodisiac; a plaster made of the ground seeds is applied to burns, scalds, &c.; a lotion made from the leaves is used as a hair-wash, and is supposed to promote the growth of the hair and make it black; a decoction of the root is said to have the same properties; a powder made from the roasted and decorticated seed is called Ráhishi in Arabic and

* جلجلان That which is جليل (a thing) great in estimation. (Ibn Abbád in Táj-el-Arús.)

(*2nd*)—The fruit of Coriander. (Siháb, Mughrib, Kámús.)

(*3rd*)—Sesame. (Siháh, Ez-Zamakhsherí, Mughrib, Táj-el-Arús.) Sesame in its husk before it is reaped. (Siháh.) The grain of Sesame. (Kámús.)

(*4th*)—The heart's core. *Lane, Madd-el-Kamús.* The name Simsim is applied by the Arabs in the present day to *S. indicum*, but formerly signified the seed of another plant called by the Persians *Jilbahang* and *Zardkhár*, and having purgative properties like hellebore.

Arwah-i-Kunjad in Persian; it is used as an emollient, both externally and internally.

Sesamum (σήσαμον) is frequently mentioned by Greek and Latin authors. Lucian (*Pisc.* 41) speaks of a σησαμαῖος πλαχους: this was probably similar to the *til ka laddu* of India.

Sesame oil was an export from Sind to Europe, by way of the Red Sea, in the days of Pliny. In the Middle Ages the plant was known as Suseman or Sempsen, a corruption of the Arabic Simsin or Samsim. It is now called by Europeans, both in India and Europe, *Jinjili, Jugeoline, Gigeri, Gengeli,* or *Gingelly,* which appear to be corruptions of the word Julj ulán. The oil is one of the most valuable of Indian vegetable oils; it keeps for a long time without becoming rancid, and is produced in large quantities in almost every part of the Peninsula. The following mode of preparation is described in the Jury reports of the Madras Exhibition:—"The method sometimes adopted is that of throwing the fresh seeds, without any cleansing process, into the common mill, and expressing in the usual way. The oil thus becomes mixed with a large portion of the colouring matter of the epidermis of the seed, and is neither so pleasant to the eye nor so agreeable to the taste as that obtained by first repeatedly washing the seeds in cold water, or by boiling them for a short time, until the whole of the reddish-brown colouring matter is removed and the seeds have become perfectly white. They are then dried in the sun, and the oil expressed as usual. The process yields from 40 to 44 per cent. of a very pale straw-coloured sweet-smelling oil, an excellent substitute for olive oil."

Hydraulic presses are now in use in the more civilized parts of India for extracting the oil, but have as yet by no means superseded the native oil mill.

Sesamum oil may be used for plaster-making, but it takes more oxide of lead than groundnut oil, and does not make so light-coloured or so hard a plaster. After a prolonged trial at the Government Medical Store Department in Bombay, its use was abandoned in favour of the latter oil for the following

reasons:—The rolls of Sesame oil plaster soften in hot weather. The plaster has a disagreeable odour. It darkens in colour when kept for any time. For liniments and ointments, except Ung. Hydr. Nitratis, it appears to be a perfectly satisfactory substitute for olive oil. F. H. Alcock (*Pharm. Journ.* [3], xv., 282) recommends its use in making Lin. Ammoniæ B. P. Sesame or Benne leaves, preferably in the fresh state, are much used in America as a demulcent in disorders of the bowels; they yield an abundant mucilage.

Description.—Annual, 2 to 3 feet; leaves opposite or upper ones alternate, ovate, oblong or lanceolate, the lower ones often 3-lobed, or 3-divided, feather-nerved; at the base of the peduncles are remarkable yellow glands; flowers solitary in the axils, resembling those of the fox-glove, from dirty white to rose-coloured, capsule velvetty and pubescent, mucronate, at first 2-celled, afterwards 4-celled; seeds numerous, without wings, ovoid, flat, white, brown, or black, rather smaller than linseed.

Chemical composition.—The following table shows the relative composition of the brown or Levantine, and yellowish or Indian, seeds:—

	Levantine.	Indian.
Oil	55·63	50·84
Organic matter	30·95	35·25
Ash	7·52	6·85
Water	3·90	7·06

the albuminoids being equal to 21·42 and 22·30 per cent. respectively in the two varieties.

In the manufacture of the oil the seeds are generally pressed three times: twice cold and the third time warm. In Calcutta, where the seeds are only pressed twice, the average yield is—

1st pressing of fine oil	36	per cent.
2nd „ „ ordinary oil	11	„

The oil-cake has the following composition :—

Water	8·25
Fat	7·63
Non-nitrogenous matter......	40·90
Albumenoids containing 5·25 per cent. nitrogen	32·82
Ash	10·40

(*Brannt.*)

For further information on Sesame oil we would refer the reader to Vol. II. of Allen's *Commercial Organic Analysis,* and to Brannt's work on *Oils and Fats.* The authors of the *Pharmacographia* say :—"The oil is a mixture of olein, stearin, and other compounds of glycerin with acids of the fatty series. We prepared with it in the usual way a lead plaster, and treated the latter with ether in order to remove the oleate of lead. The solution was then decomposed by sulphuretted hydrogen evaporated and exposed to hyponitric vapours. By this process we obtained 72·6 per cent. of Elaidic acid. The specimen of Sesame oil prepared by ourselves, consequently, contained 76·0 per cent. of olein, inasmuch as it must be supposed to be present in the form of triolein. In commercial oils the amount of olein is certainly not constant.

"As to the solid part of the oil, we succeeded in removing fatty acids, freely melting after repeated crystallizations at 67° C., which may consist of stearic acid mixed with one or more of the allied homologous acids as palmitic and myristic. By precipitating with acetate of magnesium, as proposed by Heintz, we finally isolated acids melting at 52·5 to 53°, 62 to 63°, and 69·2° C., which correspond to myristic, palmitic, and stearic acids.

"The small proportion of solid matter which separates from the oil on congelation cannot be removed by pressure, for even at many degrees below the freezing point it remains as a soft magma; in this respect Sesame oil differs from that of olive.

"Sesame oil contains an extremely small quantity of a substance, perhaps resinoid, which has not yet been isolated. It may be obtained in solution by repeatedly shaking five volumes

of the oil with one of glacial acetic acid. If a cold mixture of equal weights of sulphuric and nitric acids is added in like volume, the acetic solution acquires a greenish yellow hue. The same experiment being made with spirit of wine substituted for acetic acid, the mixture assumes a blue colour, quickly changing to greenish yellow. The oil itself being gently shaken with sulphuric and nitric acids takes a fine green hue, as shown in 1852 by Behrens, who at the same time pointed out that no other oil exhibits this reaction. It takes place even with the bleached and perfectly colourless oil. Sesame oil added to other oils, if to a larger extent than 10 per cent., may be recognised by this test. The reaction ought to be observed with small quantities, say 1 gram. of the oil and 1 gram. of the acid mixture previously cooled."

J. F. Tocher recommends the use of hydrochloric acid with a little pyrogallol for detecting the presence of Sesame oil; 14 parts of the acid and 1 part of pyrogallol are to be placed with an equal proportion of the oil to be tested in a test tube, which is corked and well shaken. The tube is then to be allowed to stand for five minutes, when, the upper layer of oil having been removed by a pipette, the acid solution is boiled for five minutes. If Sesame oil is present, it will show a purple colour when viewed by transmitted light, and a blue colour by reflected light; the latter colour is best observed when the fluid is poured into a porcelain capsule. After a time a slight blue precipitate is thrown down. Olive oil tested with this re-agent afforded a faint yellowish colour, almond, groundnut and rape oils no colour, and cotton-seed oil a very pale red. An admixture of 1 to 2 per cent. of Sesame oil with olive oil may thus be detected.

The substance obtained by Flückiger on shaking Sesame oil with acetic acid has also been investigated by Tocher; he found it to be best obtained by using 7 volumes of acetic acid to 10 volumes of oil. After removal of the acid a brown transparent gelatinous residue was left, which, upon agitation with weak potash solution and rest for twelve hours, afforded a deposit, which, after being well washed with distilled water, was boiled

with hydrochloric acid, collected on a filter, thoroughly washed to free it from acid, and dried over a water bath. It was then soluble in alcohol and crystallized on cooling from its alcoholic solution in long needles melting at 117—118° C. The needles were soluble in benzene, oil of turpentine, bisulphide of carbon, chloroform, and glacial acetic acid, but insoluble in water, alkaline solutions, and hydrochloric acid. They were neutral to test paper, and gave no colour reaction with the hydrochloric acid and pyrogallol solution, showing that this reaction is due to another principle in the oil which has not yet been isolated. (*Pharm. Journ.*, Jan. 24th, 1891.)

Sesame oil extracted by ether has a sp. gr. of 0·919 at 23° C.

Commerce.—Sesamum is commonly cultivated in India; there are two varieties, the black-seeded and the white-seeded; the former being generally known as *til*, and the latter as *tili*. *Til* ripens rather later than *tili*, and is more commonly grown, mixed with high crops, such as *Sorghum vulgare*, while *tili* does best when mixed with cotton. *Tili* oil is preferred of the two for human consumption. (*Duthie and Fuller.*)

The quantity of seed shipped from British India in the year 1871-72 was 565,854 cwts., of which France took no less than 495,414 cwts. In 1881-82, the exports from Bombay alone were 994,120 cwts., valued at Rs. 64,84,475. France continued to take about 4-6ths of the total exports. Besides this, 105,344 gals. of oil, value Rs. 1,12,122, were exported to Eastern ports. In 1884-85, the exports from the whole of India were 2,654 thousand cwts., and in 1887-88, 137 thousand tons, but in 1888-89 the exports fell to 77 thousand tons. This fall was probably due to an unfavourable season. No statistics of the consumption of the oil in India are available. It must be enormous, as Sesame oil is the food oil of all who can afford it.

PEDALIUM MUREX, *Linn.*

Fig.—*Burm. Fl. Ind., t.* 45, *f.* 2; *Gärtn. Fruct. i., t.* 58; *Wight Ic., t.* 1615; *Rheede Hort. Mal. x.*, 72.

Hab.—Deccan Peninsula, Ceylon. The leaves and fruit.

Vernacular.—Bara-gokhru (*Hind.*, *Beng.*), Peru-nerunji (*Tam.*), Pedda-palleru (*Tel.*), Káttu-nerinnil (*Mal.*), Anne-galu-gida (*Can.*), Kadva-gokhru (*Guz.*), Karonta, Ubha-gokhru, Malvi-gokhru (*Mar.*).

History, Uses, &c.—This plant does not appear to have been used medicinally by the ancient Hindus, nor do we know of any Sanskrit name for it. It is supposed by Dr. Moodin Sheriff to be the Faríd-bútí (herb Faríd), the plant upon which Shaik Faríd-ed-dín Shakar Ganj,* a Mahometan ascetic and poet, sustained life while he acquired the everlasting treasure of knowledge (Ganj-i-la-yazál-i-maárif). The following quatrain is attributed to him:—

Shabníst keh khún-i-dil-i-ghamnák naríkht. |
Rúzí neh keh ábrú-i-man pák naríkht, ||
Yak sharbat-i-áb-i-khúsh nakhúrdam hameh 'umr. |
Kán níz z'rah-i-dídeh bar khák naríkht. ||

By night I am consumed with grief,
By day I am overwhelmed with shame,
No drop of sweet water passes my lips,
But it pours in tears from my eyes.

P. Murex is the Caca-mullu of Rheede, who states that the powdered leaves are given in two-drachm doses with milk and sugar in gonorrhœa and gonorrhœal rheumatism. The fresh plant agitated in water or milk renders it gelatinous without materially altering its taste, colour or odour. This thickening disappears after some hours. A watery infusion of this kind sweetened with sugar is a favourite and excellent demulcent in acute gonorrhœa. The dried fruit is the Bara-gokhru or "great Gokhru" of the shops, and a decoction of it is used when the fresh plant is not obtainable. In the Concan a *Paushtik*, or "strengthening medicine," is made of the

* Shakarganj or "sugar store." Poison in his mouth became sugar—

سنگ در دست او گوہر گردید .·. زہر درکام او شکر گردید

His shrine is at Pák-pattan, or the Ferry of the Pure; he died A. H. 664, ninety-five years of age. Pák-pattan is in the Panjáb, between Bahwalpúr and Firúzpur, in the Sutlej Valley.

powdered fruit with *ghi*, sugar, and spices; it is taken with milk.

Dr. Emerson has observed that the juice is used as a local application to aphthæ.

P. Murex must not be confounded with the great Gokhru or Hasak of Mahometan medical writers, which is *Xanthium Strumarium*.

European writers upon Indian drugs bear evidence to the correctness of the native estimate of the medicinal value of Gokhru, and it has lately been introduced into European practice as a remedy for nocturnal seminal emissions, incontinence of urine and impotence. (*Practitioner*, XVII., 381.) It has been given in an infusion of 1 oz. of the fruit to 1 pint of boiling distilled water, this quantity being taken daily.

Description.—A spreading, low succulent plant with oval, dentate, obtusely pointed leaves; pedicels axillary, 1-flowered, shorter than the petiole, 1 to 2, or more dark-brown glandular bodies situated near the axils; flowers yellow; tube of corolla about 1 inch long; fruit pendulous, about ½ an inch long, and ¼ inch in diameter at the base, 4-angled, with a straight spine at the base of each angular ridge; above the spines is a narrow portion which is inserted into the 5-clawed calyx; when dry the fruit is corky, it is divided into two cells; the seeds are elongated, narrow, and four in number. The young branches, petioles, under-surface of leaves and immature capsules have a frosted appearance, which is due to the presence of numerous small, sessile, brilliant, crystalline, 4 to 5-partite glands. The substance of the fruit consists, in great part, of dense fibro-vascular tissue, forming a kind of 4-winged nut; the corky part consists of delicate cellular tissue; when fresh it is green and succulent. The fresh plant has a peculiar disagreeable musky odour. Simple agitation of the young branches in water, without any crushing, produces a viscid mucilage like white of egg. We find from experiment that the glandular crystalline bodies described above are the source of the mucilage; if they are gently scraped from the under-

surface of the leaf and mixed with water, the viscidity is at once produced. The mucilage has a faint peculiar taste, but is not disagreeable.

Chemical composition.—The fruits contain a greenish-coloured fat, a small quantity of resin, and an alkaloid in the alcoholic extract. The mucilage separated by water is precipitated by acetate of lead solution and alcohol, and in these respects resembles the mucilage of gum arabic. The ash of the air-dried fruit amounts to 5·43 per cent.

Martynia diandra, *Glox. Bot. Rep.* 575, "tiger's claw" or "devil's claw," is a native of Mexico, but has become quite naturalized in India, making its appearance on waste ground during the rainy season.

The plant is herbaceous, has large cordate leaves, and handsome flowers like those of Sesame. The fruit is a green fleshy capsule which contains a hard, black, woody, wrinkled nut with two anterior hooks, having something the appearance of a beetle. The natives liken it to a scorpion, hence the names *Vinchú* and *Vichhidá;* they suppose it to have a curative effect upon the sting of that reptile, the nut being rubbed down with water and applied to the injured part. It is sold in the shops.

ACANTHACEÆ.

HYGROPHILA SPINOSA, *T. And.*

Fig.—*Wight Ic.*, *t.* 449; *Rheede, Hort. Mal.* ii., *t.* 45.

Hab.—Throughout India. The plant and seeds.

Vernacular.—Tálmakhára, Tálmakhána (*Hind.*), Kuliakhára (*Beng.*), Kolista, Kolsunda (*Mar.*), Ekháro (*Guz.*), Kulugolike, Kolavalike (*Can.*), Nirmulli (*Tam.*), Nirugobbi (*Tel.*), Vayalchulli (*Mal.*).

History, Uses, &c.—This plant bears the Sanskrit names of Ikshura, Kshura, Ikshugandha, and Kokiláksha, "having

eyes like the Kokila, or Indian Cuckoo." The bluc flowers are used in the *Lákholi* ceremony, which is an offering to Mahadeva of a lakh each (100,000) of the five grains (पंचधान्ये), and a lakh each of a number of different flowers. Counting these occupies the women of the house for about a month. As a medicine the Hindus consider *H. spinosa* to be cooling, diuretic, and strengthening; the root, seeds, and ashes of the plant are in general use, and are prescribed in hepatic obstruction with dropsy, rheumatism, and uriuary affections. The seeds are one of the *Panchavija*, or "five seeds," the others being those of Celastrus, Fenugreek, Ajwan, and Cumin. There are, however, several other sets of five seeds. Mahometan writers mention the use of the plant for the same purposes, and also its external application in rheumatism, but they notice more especially the use of the seeds as an aphrodisiac given either with sugar, milk or wine in doses of from one to three dirhems. Ainslie, speaking of this plant, say:—" This root, which has got its Tamool name from growing near water, is supposed to have virtues similar to those of the Moollie-vayr (*Solanum indicum*, Linn.) already mentioned. The plant is the *Bahel-schulli* of Rheede, who tells us that on the Malabar Coast a decoction of the root is considered as diuretic and given in dropsical cases and gravelish affections; the dose is about half a teacupful twice daily. The species in question is a native of the Western Coast of India, whence the root is brought across the peninsula to the medicine bazars of the Carnatic. Our article is called Katu-irki by the Cingalese." (*Mat. Ind.*, II., p. 236.) In the *Pharmacopœia of India* several European contributors bear testimony to the diuretic properties of the plant, but no mention is made of the use of the seeds as an aphrodisiac and diuretic. In Bombay they are very generally used and are to be found in every druggist's shop.

Description.—Roots often biennial, tapering, with numerous rootlets; stems herbaceous, ascending or erect, ramous, jointed, a little flattened, hairy, from 2 to 3 feet high; branches opposite, like the stem, and also nearly erect; leaves an exterior, opposite, sessile pair at each joint, within these and subalternate with the spines, several small ones in a verticel: all are linear-

lanceolate, margins often revolute, hairy, almost bristly, size various; spines 6 in each verticel, between the leaves and flowers, awl-shaped, spreading and a little recurved; flowers verticelled, numerous, sessile, large, of a bright blue; bracts lanceolate, margins and outside bristly; calyx of two pairs of nearly equal leaflets, clothed with soft hair; corol 2-lipped, lips nearly equal; upper 2-parted, with the division emarginate, the under one 3-parted, with the division also emarginate, in the under a coloured body like a large oblong anther; filaments connected at the base, second pair larger than usual in the genus; anthers sagittate; stigma subulate, involute, with a fissure on the upper side. (*Roxb.*) The seeds are small and flattish, of irregular form and brown colour, the largest $\frac{1}{10}$ of an inch long and $\frac{1}{16}$ broad. When placed in the mouth they immediately become coated with a large quantity of extremely tenacious mucilage, which adheres to the tongue and palate and is of rather agreeable flavour.

Microscopic structure.—When a section of the seed is placed under the microscope with a drop of water the development of the mucus may be observed. It appears to spring in filaments from the columnar cells of the testa; these spread rapidly in every direction and form a network which resembles the growth of some of the lower forms of algæ; it does not dissolve when much water is added.

Chemical composition.—The roots with the lower portion of the stems were air-dried, contused, and exhausted with 80 per cent. alcohol. On concentrating the tincture, white cauliflower-like masses separated. After the whole of the alcohol had been evaporated off, the extract, which had a very strong acid reaction, was mixed with water and agitated with petroleum ether, then with ether, and finally, after having been rendered alkaline, re-agitated with ether. The petroleum ether solution on evaporation left a crystalline residue, partly in the form of white cauliflower-like nodules, and a crystalline deposit on the sides of the dish. Examined microscopically, both the nodules and the deposit were seen to consist of rod-shaped crystals. After repeated crystallization from

alcohol, and pressing the crystals between blotting paper, by which much colouring matter and a trace of oil was separated, the residue, which was nearly white, possessed the following properties:—On being heated between watch-glasses it melted into an amber-coloured fluid, and after the lapse of some hours the glasses were filled with a white, wool-like sublimate. In water the principle was insoluble, and it was not acted upon by ammonia or dilute sodium hydrate. In concentrated sulphuric acid it dissolved with a yellow coloration, and on dilution the solution became milky. On gently heating the sulphuric acid solution and then diluting with water, a pinkish turbid fluid resulted; when chloroform was agitated with this fluid it became coloured either pink, violet, greenish or even blue, the tint appearing to depend on the degree of heat applied to the acid solution before dilution with water. The principle dissolved in chloroform, and the solution when agitated with an equal volume of concentrated sulphuric acid, failed to give the colour reaction in the chloroform layer for cholesterin, but the sulphuric acid stratum exhibited a very marked green fluorescence.

Evaporated to dryness with nitric acid a yellow residue was left, which, on the addition of ammonia, became of an orange-yellow colour, but without any trace of redness. When the solid principle was evaporated to dryness with HCl and ferric chloride, it was difficult to say what colour the residue was. The test, however, applied as described by C. Forti (*Stay. Sperim. Agri. Ital.* 18, 580), by first dissolving the principle in chloroform, adding a little strong ferric chloride and concentrated hydrochloric acid, and evaporating to dryness, left a dark-coloured residue; this, when dry and cold, was treated with chloroform and gently warmed, when a fine violet-coloured solution was afforded. The acid ethereal extract contained yellow colouring matter and possessed an aromatic odour. The alkaline ethereal extract contained a principle which afforded in a marked degree alkaloidal reactions, but we failed to obtain any special colour tests.

The seeds are glutinous, besides being mucilaginous. They contain 4·92 per cent. of nitrogen, which is equivalent to 31·14

per cent. of albuminoids, traces of an alkaloid, and 23 per cent. of a yellow fixed oil. The mucilage is not affected by ferric chloride, plumbic acetate, or by two volumes of alcohol.

Commerce.—The seeds are kept by all druggists. Value Rs. 6 per maund of 37½ lbs. The root is an article of commerce in Southern India; elsewhere it is generally supplied by the herbalists.

Several species of **Strobilanthes** yield stems as thick as a walking-stick and quite straight, which are used, like bamboos, in the construction of mud walls and fences. The aromatic flower spikes of some of these plants are used as a rustic medicine by the natives. The bark of *S. callosus*, Nees, with an equal quantity of Undi bark (*Calophyllum inophyllum*), is used in Western India as a fomentation in tenesmus; the bark-juice, with an equal quantity of Máka-juice (*Eclipta alba*), boiled to one-half, is mixed with old Sesamum oil, a few peppercorns and ginger, heated and applied in parotitis; equal parts of the juice of the flowers and of those of *Randia dumetorum* are used as an application to bruises.

The flower spikes of this plant resemble hops in shape and size, and are covered with a viscid resinous exudation called *Mél*, having a musky and resinous odour.

BLEPHARIS EDULIS, *Pers.*

Fig.—*Burm. Fl. Ind., t.* 42; *Delile Fl. Æg., t.* 33, *f.* 3.

Hab.—Punjab, Sind, Persia. The seeds.

Vernacular.—Utanjan (*Ind. Bazars*).

History, Uses, &c.—Under the local name of Utanjan and the Persian name Anjurah, an Acanthaceous seed is sold in the Indian bazars. From an examination of the capsules which are sometimes found mixed with the seeds, there would appear to be little doubt that they are those of the plant placed at the head of this article. Utanjan is a standard native remedy and is universally kept in the druggists' shops. The author of

the *Makhzan-el-Adwiya* (article Anjurah) gives us the following account of it, from which it would appear that the true Anjurah is the *Urtica prima* of Matthiolus (*U. pilulifera*, Linn.),* and that the seeds now in use in India have somehow come to take the place of the genuine article. He says:— "Anjurah is a Persian word; it is the Karíz of the Arabs, the Kurnah of Shiraz, the Kajít of the Turks, the Utanjan of the Indians, the Urtikparim of Latin writers, and the Harkitah of Gilan. The plant has numerous serrate leaves, which are armed with prickles, the stem is still more prickly; when it comes in contact with the body it causes redness, burning, and itching. The flowers are yellow. The seeds smooth and shining, flattened, of a brownish colour, larger than those of Sesamum, and altogether not unlike linseed. They are the officinal part, and if good should be heavy and of a brown colour." Medicinally they are considered to be attenuant, resolvent, diuretic, aphrodisiac, expectorant, and deobstruent.†

Description.—The Utanjan of the Indian shops consists of the seeds mixed with a variable proportion of broken pieces of the capsule and a few entire fruits. The latter are mitre-shaped, about $\frac{3}{10}$ of an inch long and $\frac{2}{10}$ broad, laterally compressed, sides furrowed, surface polished, of a chestnut colour; capsule 2-celled, 2-seeded; seeds heart-shaped, flat, covered with long, coarse hairs; when soaked in water the hairs disintegrate and produce a large quantity of viscid mucilage.

Microscopic structure.—Each hair is made up of several columnar cells, each of which contains a spiral fibre, which upon the solution of the cell wall uncoils and imparts an unusual stringiness to the mucilage.

Chemical composition.—The bitter principle of the seeds is a white crystalline body soluble in water, amylic and ethylic alcohol, but insoluble in ether and petroleum ether. It gives

* The Roman Nettle, *Urtica prima*, Matth. Valgr. v. 2, 469. It has brown polished seeds.

† Conf. Dios. iv., 89. περὶ ἀκαλύφης, also Galen; they recommend it as an expectorant.

a reddish colour with sulphuric acid, green at the margin if impure, and is best distinguished by the fine violet colour its solutions impart when brought into contact with ferric salts. With H^2SO^4 and $K^2CR^2O^7$ an agreeable odour of salicylous acid is evolved. It is associated with a substance which reduces Fehling's solution. Another white crystalline principle is present in the seeds which is not bitter, and does not give colour reactions with sulphuric acid and ferric salts. The latter crystals melted on the surface of heated mercury at 225°. The aqueous extract of the seeds contained much mucilage and vegetable albumen. The ash amounted to 7·1 per cent.

Commerce.—Utanjan is imported into Bombay from Egypt. Value Rs. 1½ per lb. In Sind and Northern India it is collected locally.

ACANTHUS ILICIFOLIUS, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 48. Holly-leaved Acanthus (*Eng.*).

Hab.—Sea Coasts of Malabar, Ceylon, and the Sunderbunds. The plant and root.

Vernacular.—Hárkúchkánta (*Hind., Beng.*), Márándi (*Mar.*), Moranna (*Goa.*), Paina-schulli (*Mal.*).

History, Uses, &c.—Roxburgh states that the Sanskrit name of this plant is Hárikasa, but we cannot find any plant bearing this name mentioned by Hindu medical writers.

Ainslie calls the plant "Holly-leaved Acanthus," and says that Rheede mentions the use of the tender shoots and leaves ground small and soaked in water as an application to snake-bites. Bontius commends its expectorant qualities. It is a plant in great request among the Siamese and Cochin-Chinese, and is called by the latter *Cay-o-ro,* who consider the roots to be cordial and attenuant, and useful in paralysis and asthma. (*Flora, Cochin Chin.,* Vol. II., p. 375.) In the Concan a decoction of the plant with sugar-candy and cumin is given in dyspepsia with acid eructations. In Goa the leaves which

abound in mucilage, are used as an emollient fomentation in rheumatism and neuralgia.

Description.—A common shrub in and on the edges of salt or brackish lakes, marshes, &c. Roots ramous, stems many, erect; branches few, bark smooth; prickles stipulary, four-fold, short, but very sharp. Leaves opposite, short-petioled, oblong, scolloped, waved, spinous, dentate; polished on both sides, of a firm texture, from four to six inches long, and about two broad. Spikes generally terminal, sometimes axillary, erect. Flowers solitary, opposite, large, blue, inodorous. Capsule oblong, ovate, smooth, size of an acorn, 2-celled, 2-valved. Seeds two in each cell, obliquely cordate, compressed. (*Roxburgh*).

Chemical composition.—The powdered leaves yielded to ether a quantity of fatty matter coloured strongly with chlorophyll and some soft resins. Alcohol removed more resin, an organic acid, and a bitter alkaloid. The alkaloid gave a reddish-brown colour with sulphuric acid, and was precipitated from its solutions by the usual reagents, including the volatile and fixed alkalies. Some soluble saline matter was present in the extracts of the leaves, and contributed largely to the 16·4 per cent. of total ash obtained from the air-dried leaves.

BARLERIA PRIONITIS, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 41; *Wight Ic.*, 452 ; *Rumph. Herb. Amb. vii.*, 13.

Hab.—Tropical India. The plant.

Vernacular.—Jhinti, Katsareya (*Hind.*), Kántajáti (*Beng.*), Vajradanti, Kalsunda, Pivala-koránta (*Mar.*), Shemmulli, Vara-mulli (*Tam.*), Múlu-govinda (*Tel.*); Kánta-shelio (*Guz.*), Goratige, Gorati (*Can.*).

History, Uses, &c.—This small shrub is the Kuranta, Kuruvaka or Kuravaka of the Hindu poets, who compare its yellow flowers to a flash of lightning. In the Gita Govinda the

jealous Radha pictures to herself the absent Hari binding them in the floating locks of the Gopis. Other Sanskrit names are Amlana, Pitajhinta, Mahasaha, and Kuruntaka. Though not mentioned in the Nighantas, its medicinal properties appear to be very generally known; it is the *Coletta Veetla* of Rheede, and the *Hystrix frutex* of Rumphius.

The natives apply the juice of the leaves to their feet in the rainy season to harden them, and thus prevent the maceration and cracking of the sole which would otherwise occur. Ainslie says that the juice of the leaves, which is slightly bitter and acid, is a favourite medicine of the Hindus of Lower India in those catarrhal affections of children which are accompanied with fever and much phlegm; it is generally administered in a little honey or sugar and water in the quantity of two table-spoonfuls twice daily. (*Materia Indica*, II., p. 376.)

In the Concan the dried bark is given in whooping cough, and 2 tolás of the juice of the fresh bark with milk in anasarca. Dr. Bidie observes that it actsas a diaphoretic and expectorant.

A paste is made of the root which is applied to disperse boils and glandular swellings, and a medicated oil, made by boiling the leaves and stems with sweet oil until all the water has been driven off, is used as a cleansing application to wounds.

Description.—Stem short, erect; branches numerous, opposite, erect, round, smooth; the whole plant two or three feet high. Thorns axillary, generally about four, straight, slender, sharp. Leaves opposite, decussate, short-petioled, oblong, somewhat waved, mucronate, smooth. Flowers axillary, generally solitary, sessile, large, yellow. Capsule conical, 2-seeded, one seed in each cell. Root woody, perennial, with numerous lateral rigid rootlets.

Chemical composition.—With the exception of the large amount of a neutral and acid resin soluble in light petroleum ether, nothing of special interest was detected: there was no trace of any alkaloidal principle.

Barleria noctiflora, *Linn.* Dr. Mootooswamy says that in Tanjore a decoction of this plant is a good adjunct to and substitute for human milk.

The following plant is classed by the natives along with the Barlerias, of which *B. cristata* and several other species appear to be included by the Sanskrit names Kuruntaka, Kuruvaka, and Artagala. In Hindi Jhinti is a kind of general name for these plants, and in Marathi Koránta and Áboli.

Crossandra undulæfolia, *Salisb. Bot. Mag.* 2186; *Wight Ic., t.* 461; *Rheede, Hort. Mal. ix.*, 62, is a native of the Deccan Peninsula and Ceylon, and is much cultivated about Hindu temples in other parts of India, probably on account of the colour of the flowers, which is like that of the dress of the Bhikshu or penitent. The plant bears the synonym of Priya-darsha, "pleasant to look at," and the flowers are much worn by Brahmin women in the hair. The capsules, which resemble grains of barley, are described in the *Makhzan-el-Adwiya* under the Arabic name of Asába-el-usúl as highly aphrodisiac; they afford much amusement to children from their peculiarity of suddenly bursting with a crack when moistened and projecting their seeds.

Dædalacanthus roseus, *T. And.*, a native of Western India, has tuberous, spindle-shaped roots, usually ten in number, as thick as a quill, several inches in length and covered by a dark-brown bark; leaves elliptic, glabrous, scabrous on the veins beneath; spikes axillary-peduncled, imbricated; bracts oval, somewhat wedge-shaped, acute, ciliated, with long hairs, reticulately veined; tube of corolla very long and slender; flowers deep blue, turning bright red as they fade. The root boiled in milk is a popular remedy for leucorrhœa; dose one drachm. In the Southern Concan it is given to pregnant cattle to promote the growth of the fœtus. The Marathi name is Dasamuli, "having ten roots."

Neuracanthus sphærostachyus, *Dalz. Hook. Ic. Pl., t.* 835, is a native of Western India. It is powdered and

made into a paste which is used to cure ringworm, and the roots are administered in that form of indigestion in which fatty or saponaceous grape-like masses are observed in the stools. They resemble Serpentaria in appearance, but may be distinguished by the thick covering of white, silky hairs upon the root stock. The roots have hardly any taste. The Marathi name is Ghosvel.

ANDROGRAPHIS PANICULATA, *Nees.*

Fig.—*Bentl. and Trim.*, *t.* 197; *Wight Ic.*, *t.* 518; *Rheede, Hort. Mal. ix.*, *t.* 56.

Hab.—Throughout India, wild or cultivated. The herb.

Vernacular.—Kiryat (*Hind.*), Olen-kiraita (*Mar.*), Kálmeg (*Beng.*), Shirat-kuchchi, Nila-vembu (*Tam.*), Nela-vemu (*Tel.*), Nila-veppa (*Mal.*), Nela-bevinagida (*Can.*), Kiryáto (*Guz.*).

History, Uses, &c.—Concerning this plant, Dutt (*Hindu Mat. Med.*, p. 216) states that there is some doubt regarding its Sanskrit name. He says:—"A plant called Yavatiktá, with synonyms of Mahátikta, Sankhini, &c., is said by some to mean this herb, but the term Mahátikta, when occurring in Sanskrit prescriptions, is usually interpreted as *Melia sempervirens*, Sw.,* and Yavatiktá has not been noted by me as having occurred in any prescription, so that I am inclined to think *Andrographis paniculata* was not used in Sanskrit medicine. The plant is well known in Bengal under the name of Kálmeg, and is the principal ingredient of a domestic medicine called *Alui*, which is given to infants for the relief of griping, irregularity of the bowels, and loss of appetite." It is prepared in the following manner:—Take equal parts of cumin, *randhani* (fruit of *Carum Roxburghianum*), aniseed, cloves, capsules of greater cardamoms, and pound them thoroughly with the expressed juice of the leaves of the Kálmeg. The mass thus prepared is divided into small pills and dried in the sun. The dose is one pill rubbed down in human milk.

* *M. Azedarach*, Linn.

Both Hindu and Mahometan medical writers would appear to have confounded this drug with chiretta.* According to Forskahl, it is common in Arabia, and is there called *Wizr.* (*Forsk. Flor. Aeg. Ar.*, CII.)

Moodin Sheriff points out that *Cara Caniram*, the name given to this plant by Rheede, signifies "Black Strychnos;" he therefore thinks it must be incorrect.

Ainslie speaks of the plant as having been brought to the southern parts of the Indian Peninsula from the Isle of France.

Flückiger and Hanbury in their *Pharmacographia* point out that it has been wrongly supposed to be a constituent of the famous bitter tincture called by the Portuguese of India *Droga amara*. In the *Pharmacopœia of India* it has been made official, and directions for making a compound infusion and compound tincture are given. Quite recently, under the name of *Halviva*, which appears to be a corruption of the Bengali word *alui* or *alvi*, a preparation of the drug has been advertised in England as a substitute for quinine. The herb is very common in shady situations as a weed of cultivation, and is much used by the natives as a domestic remedy for fever in combination with aromatics, especially with lemon-grass. The dose of the dried leaves is about ten grains combined with twenty grains of black pepper. In the Concan, Kirait, Ginger, and Dikamali are given in fever, and the fresh juice with black pepper, rock salt, and Asafœtida in colic. In the chronic febrile condition known as *Bariktáp*, Kirait, Ginger, Picrorhiza root, wild dates, and Conessi bark are infused and given with honey every morning. **A. echioides**, *Nees*, is said to have similar medicinal properties; it is the *Peetumba* of Rheede (ix., 46), who says that the juice is given in fever. **Haplanthus verticillaris**, *Nees*, and **H. tentaculatus**, *Nees*, bear the name of *Kala-kirait* in Western India, and are used medicinally. The Hindi name for these two plants is *Kastula* and the Marathi *Jhánkara*.

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* The name *Kiryat* is loosely applied to many bitter drugs.

Description.—Annual, 1 to 3 feet; stem quadrangular, pointed, smooth; leaves opposite, on short petioles, lanceolate, entire upper surface dark-green and shining, under surface paler and finely granular: they vary much in size, but the larger are usually about 3 inches in length and 1 inch in breadth; calyx deeply 5-cleft; corolla bilabiate; lips linear, reflected, upper one 3-toothed, lower one 2-toothed; flowers remote, alternate, on long petioles, downy, rose-coloured, or white streaked with purple; capsules erect, somewhat cylindrical; seeds 3 to 4 in each; root fusiform, simple, woody, with numerous fine radicles.

Chemical composition.—According to the authors of the *Pharmacographia*:—"The aqueous infusion of the herb exhibits a slight acid reaction and has an intensely bitter taste, which appears due to an indifferent, non-basic principle, for the usual reagents do not indicate the presence of an alkaloid. Tannic acid, on the other hand, produces an abundant precipitate, a compound of itself with the bitter principle. The infusion is but little altered by the salts of iron; it contains a considerable quantity of chloride of sodium."

Commerce.—*A. paniculata* is not an article of commerce, but the fresh plant is sold by the herbalists and gardeners.

JUSTICIA.

Several species of Justicia are reputed to be medicinal amongst the peasantry.

Justicia Gendarussa, *Linn., f.*, is the *Vedakodi* of Rheede (*Hort. Mal. ix., t.* 42), who says that the juice with mustard is used as an emetic in asthma, and a bath of the leaves in rheumatism. According to Louvet, it is emetic and very efficient in the colic of children. In Réunion it is called "*Guerit petit colique.*"

Description.—In gardens it is usually seen in a stunted form, as it is kept closely cut; the young shoots have a smooth

green or purple bark; from the joints, which are somewhat tumid, spring secondary shoots. The leaves are opposite, short-petioled, lanceolar, obtuse, frequently a little scolloped, smooth; nerve and veins purple, or green, according to the variety, from 3 to 6 inches long, and ½ to 1 inch broad; spikes terminal, erect; flowers dirty white, spotted with purple. The odour of the plant when crushed is ferny, the taste peculiar, and not disagreeable.

Justicia procumbens, *Linn. Wight. Ic., t.* 1539, a native of the South Deccan and Ceylon. [*Vern.*—Ghâti-pitpáprá (*Mar.*), Nereipoottie (*Tam.*)] is a small plant, very abundant in the rainy season. The whole herb is gathered when in flower and dried. It has a faintly bitter disagreeable taste, and is used as a substitute for Fumaria, the true Pit-páprá. According to Ainslie the juice of the leaves is squeezed into the eye in cases of ophthalmia (II. 246).

Description.—Stem procumbent, diffuse; leaves lanceolate-elliptic or rounded, glabrous or sparingly hairy; spikes compressed, slender; calycine segments lanceolate, membranous on the margin, minutely ciliated; bracts of the same shape and shorter than the calyx; flowers small, pale purple; root slender, long, woody, straight, with numerous slender stems spreading from the crown. The bitterness of the plant is due to an alkaloid.

Justicia picta, *Roxb. Rheede, Hort. Mal. vi., t.* 60; *Bot. Mag., t.* 1870, a well-known garden shrub, is used medicinally in the same manner as *Adhatoda Vasica.* The variegated variety is called 'White Adulsa,' and the dark-leaved kind 'Black Adulsa'; the first is, according to Rumphius (vi., 35), used pounded with the milk of the cocoanut to reduce swellings. Loureiro states that the leaves are emollient and resolvent, and notices their use as a cataplasm to inflamed breasts caused by obstruction to the flow of milk.

Justicia Ecbolium, now **Ecbolium Linneanum,** *Kurz. Wall. Pl. As. Rar. iii., t.* 108; *Bot. Mag., t.* 1847, is a small

shrub, the roots of which have a reputation in the Concan in jaundice and menorrhagia. Rheede (*Hort. Mal. ii.*, 20) notices the use of the whole plant in gouty affections and dysuria.

Description.—Stems several, straight, jointed, and swelled above the joints; woody and round below, quadrangular and tender above; leaves elliptic-oblong, attenuated at both ends, pubescent, or glabrous; spikes terminal, tetragonal; bracts oval, quite entire, ciliated, mucronate, as long as the capsule; flowers azure-coloured; capsule half an inch long, 2-seeded.

ADHATODA VASICA, *Nees.*

Fig.—*Lam. Ill., t.* 12, *f.* 1; *Bot. Mag., t.* 861; *Griff. Ic. Pl. As., t.* 424; *Rheede Hort. Mal. ix., t.* 43. Malabar nut tree (*Eng.*)

Hab.—India, from the Punjab and Assam to Ceylon. The leaves, root, and flowers.

Vernacular.—Arúsa, Rús, Bánsa (*Hind.*), Adúlsa (*Mar.*), Bákas (*Beng.*), Adúlso, Bánsa (*Guz.*), Ádátodai (*Tam.*), Addasaram (*Tel.*), Áta-lotakam (*Mal.*), Adúsála, Ádúsoge (*Can.*).

History, Uses, &c.—This shrub has a considerable reputation all over India as an expectorant and antispasmodic, and is largely prescribed in consumption and other chest affections attended with cough and hectic fever. Sanskrit writers call it Vasaka, Vansa, Vrisha, Sinha-mukhi "lion-mouthed" Sinhaparni "lion-leaved," and Atarúsha, Atarusha or Atarúshaka, and direct the fresh juice of the leaves to be given in doses of one tolá (180 grs.), with the addition of honey and long pepper, in cough. Dutt, in his *Hindu Materia Medica*, gives several compound preparations of the drug extracted from Sarangadhara and the Bhavaprakasa, and remarks that there is a saying that no man suffering from phthisis need despair as long as the Vasaka plant exists. In the Nighantas it is described as removing phlegm, bile, and impurities of the blood, a remedy for asthma, cough, fever, vomiting, gonorrhœa, leprosy, and phthisis. Persian writers upon Indian Materia Medica notice the plant under its Hindustani name of Arúsa. The author of

the *Makhzan-el-Adwiya* describes it correctly, and says that the wood is used to make toothpicks and gunpowder. Medicinally the flowers are useful in hectic, heat of blood, and gonorrhœa, the root in cough, asthma, febrile disturbances, and gonorrhœa; the fruit is sometimes hung round the necks of children to keep them from catching cold. Ainslie states that "In Ceylon, the Malabar nut tree is said to grow to the height of fourteen or fifteen feet, and is there called Wanapala. The flowers, leaves, and root, but especially the first, are supposed to possess antispasmodic qualities; and are prescribed in certain cases of asthma, and to prevent the return of rigor in intermittent fever; they are bitterish and sub-aromatic, and are administered in infusion and electuary. In the last mentioned form the flowers are given to the quantity of about a teaspoonful twice daily." (*Mat. Ind.*, II., p. 3.) Roxburgh remarks that the wood is well fitted for making charcoal for gunpowder. Strong testimony in favour of the remedial properties of the drug was furnished to the authors of the *Pharmacopœia of India* by Drs. Jackson and Dutt, who employed it with marked success in chronic bronchitis, asthma, and other pulmonary and catarrhal affections. Cases illustrative of its effects in catarrh, bronchitis, and phthisis have been published by Mr. O. C. Dutt. (*Indian Annals of Med. Sci.*, 1865, Vol. X., p. 156.) In Bengal the leaves are smoked in asthma; good evidence of their value when thus used has been collected by Dr. G. Watt in the "*Dict. of the Economic Products of India.*" Dr. Watt has also brought to notice the use of Adhatoda leaves in rice cultivation in the Sutlej Valley. The fresh leaves are scattered over recently flooded fields prepared for the rice crop, and the native cultivators say that they not only act as a manure, but also as a poison to kill the aquatic weeds that otherwise would injure the rice. Experiments conducted by us show that the infusion acts upon the cells of these plants in the same manner as certain chemical reagents, by contracting their contents and causing their disintegration; it also proves poisonous to any animalcules, frogs, leeches, &c., present in the water; on the higher animals the leaves do not have this effect.

Description.—A small tree or large shrub, flowering in the cold season; trunk straight; bark pretty smooth, ash-coloured; branches sub-erect, with bark like that of the trunk, but smoother; leaves opposite, short petioled, broad lanceolar, long, taper-pointed, smooth on both sides, about 5 to 6 inches long and 1½ broad; spikes from the exterior axils, solitary, long-peduncled, the whole end of the branchlet forming a leafy panicle, flower-bearing portion short, and covered with large bracts; flowers opposite, large, white, with small ferruginous dots, the lower part of both lips streaked with purple; bracts 3-fold, opposite, 1-flowered, exterior one of the three, large, ovate, obscurely 5-nerved interior pair much smaller, end sub-lanceolate, all are permanent; calyx 5-parted to the base, divisions nearly equal; corolla ringent, tube short, throat ample, upper lip vaulted, emarginate, lower lip broad and deeply 3-parted, both streaked with purple; filaments long, resting under the vault of the upper lip; anthers twin. (*Roxb.*)

Chemical composition.—The powdered leaves have a light green colour with a strong peculiar odour and a bitter taste. One of us has published the following report of a chemical examination: "Soaked in water and then boiled, the powder afforded 34 per cent. of a reddish-brown extract having the characteristic properties of the leaves. Incinerated at a low red heat 17 per cent. of ash was left. A remarkable alkalinity pervaded the drug, which was noticeable in the cold aqueous infusion, in the distillate obtained by boiling with water, and in the fumes given off when burning; the leaves when smoked in a pipe produced no narcotic effect; the chief result of the smoking was the evolution of much ammoniacal vapour among other products of combustion, and to the inhalation of this vapour is probably due the efficacy of the leaves in the relief of asthma. A well-defined alkaloid appears to be the most important constituent; it constitutes the bitter principle, and to all intents and purposes is the active principle. It occurs in white transparent crystals belonging to the square prismatic system, without any odour, but with a decidedly bitter taste. It is soluble in water with an alkaline reaction, and in ether, but more so in

alcohol. It readily forms salts with sulphuric, hydrochloric, nitric, and acetic acids; these salts are crystalline, and their solutions may be evaporated without apparent decomposition. It is precipitated by potassio-mercuric iodide, iodine in potassium iodide, tannin, and Nessler's reagents. A solution of the sulphate, observed in a Laurent's polariscope, possessed a slight right-handed rotation. Heated on platinum foil it fused to a yellowish and then to a fine red mass, which afterwards blackened and decomposed. Distilled with strong potash it yielded an oily body resembling chinoline, together with ammonia and other volatile bases. I propose to call this alkaloid "*Vasicine*," after the Sanskrit name of the plant. In a proximate analysis of the leaves, petroleum ether was first used to remove the volatile oil, or stearopten, which formed one of the odorous principles. Ether was then employed to extract chlorophyll, wax, resins, and a small quantity of alkaloid. The alcoholic extract was the most interesting, as it contained most of the alkaloid in neutral combination with an organic acid. This extract was of a reddish colour when concentrated, and some soft resin was separated by treatment with water; the aqueous solution evaporated spontaneously fell into a mass of crystals exhibiting right-angled ramifications. On adding neutral acetate of lead to some of the solution, nearly all the colouring matter was removed as an orange precipitate, and an almost pure solution of the acetate of the alkaloid was left in the filtrate.

The organic acid, presumably the colouring agent of the leaves, when liberated from its lead salt by sulphuretted hydrogen, had an acid reaction, was soluble in water and spirit, and gave a dark olive-green colour with ferric chloride. The colouring matter was intensified by the addition of the fixed and volatile alkalies, and was not immediately precipitated by the mineral acids. Its lead salt after gentle ignition left 28·3 per cent. of oxide. I would suggest for this organic body the name of "*Adhatodic Acid*," after the South Indian name of the plant. The occurrence of this organic acid and the alkaloid in the aqueous solution of the alcoholic extract would indicate their natural existence in a state of combination, so that adhatodate

of vasicine has scientific claims to be regarded as the active principle of the leaves of *A. Vasica.* The analysis of the leaves reveals certain principles resembling those found in tobacco, as, for instance, an odorous volatile principle, an alkaloid, but not volatile like nicotine, one or more organic acids, sugar, mucilage, and a large percentage of mineral salts. The leaves of Adhatoda submitted to dry distillation evolved substances similar to tobacco under the same conditions. At first water condensed, and an intolerable odour arose from a yellow oily liquid which followed. Then a brown oily substance came over, associated with the pungent vapour of ammonia; and finally a thick brown semi-crystalline solid was driven from the retort to the condensor. These products were all strongly alkaline. The following table gives the results of the proximate analysis of the leaves:—

Volatile odorous principle	0·20
Chlorophyll, fat, resins, and alkaloid extracted by ether	3·20
Adhatodate of vasicine, resin, and sugar extracted by alcohol	12·50
Gum	3·87
Colouring matter, precipitated by lead ...	4·83
Other organic matters and salts extracted by water	10·38
Extracted by soda solution	4·72
Residue organic	40·71
„ inorganic	9·59
Moisture and loss	10·00
	100·00

The ash was constituted as follows:—

Soluble in water	23·38
Soluble in acid	75·12
Residue	1·50
	100·00

The portion soluble in water was alkaline, and contained chlorides and sulphates. (*Pharm. Jour.*, April 7th, 1888.)

Commerce.—The dried flowering branches are sold in the shops. Value, Rs. 3½ per maund of 37½ lbs.

RHINACANTHUS COMMUNIS, *Nees.*

Fig.—*Bot. Mag., t.* 325; *Rheede, Hort. Mal. ix., t.* 69.

Hab.—Deccan Peninsula, Ceylon. Cultivated throughout India. The leaves and root.

Vernacular.—Palak-juhi (*Hind.*), Joi-páni (*Beng.*), Gajkarni (*Mar.*), Nága-malli (*Tam.*), Nágamalle (*Tel.*), Puzhuk-kolli, Pushpa-kedal (*Mal.*), Nága-mallige (*Can.*), Gachkaran (*Guz.*).

History, Uses, &c.—Indian works on Materia Medica give various prescriptions for the use of the juice of the leaves, and the root bark of this plant as a remedy for the affection of the skin known to Europeans in India as Dhobie's itch, Malabar itch, &c. (*Tinea circinata tropica.*) Whichever part of the plant may be used, it is directed to be made into a paste with lime juice or with aromatics, and applied for several successive days to the affected place. Native testimony in favour of its efficacy is very strong. (Confer. *Makhzan-el-Adwiya*, article "*Palak-Juhi.*") Ainslie, speaking of the *Justicia nasuta*, Linn., says:—"This root fresh, when bruised and mixed with lime juice, is considered as a sovereign application for ringworms and other cutaneous affections; the leaves are also employed for the same purposes. The plant is the *Pulcolli*, also *Peelcolli*, of the *Hort. Mal.* (IX., p. 135, t. 69). I have taken the liberty of giving it the English name of Nagamullie, by which it is universally known in Lower India." (*Mat. Ind.*, II., p. 216.) Roxburgh in his *Flora Indica* (I., p. 121) states that besides its use as a remedy for ringworm, milk boiled on the roots is reckoned by the Indian physicians aphrodisiacal; the roots, he also says, are used for the bite of poisonous snakes, hence the Telinga and Tamul name Naga-mulli, or Jasmine of the Cobra-di-capello. *R. communis* is very common in gardens and grows wild upon the Western Ghauts. Roxburgh gives Yúthikaparni as the Sanskrit name, but this name is applied by

Hindu writers to a kind of Jasmine. Latterly, under the name of *Tong-pang-chong*, Rhinacanthus has found considerable favour in Europe as a remedy for chronic eczema and some other skin affections of a similar character. An extract of the plant appears to be the best preparation.

Description.—A thin shrub, about 5 feet in height. Root woody, ramous; stems many, erect, ramous, the old woody parts round, and covered with pretty smooth, ash-coloured bark, the tender branches and young shoots jointed, smooth, and obscurely 6-sided; leaves opposite, petioled, broad-lanceolate, point obtuse, above smooth, below a little downy, entire, from 2 to 4 inches long and from 1 to 2 broad; panicles corymbiform, axillary, and terminal, always 3-cleft, as also the sub-divisions; peduncles and pedicels short, round, a little downy; bracts minute; flowers small, white; corol with a long, slender compressed tube, under lip broad, 3-cleft, upper lip erect, linear sides reflected, apex bifid; nectary, a fleshy ring surrounding the base of the germ; anthers without the tube, twin. (*Roxb.*) The leaves when chewed have a pungent taste something like cassia bark; their odour when crushed is disagreeable.

Chemical composition.—Liborius has analysed the root in the Dorpat Laboratory, finding in it 13·51 per cent. of ash and 1·87 per cent. of *Rhinacanthin*, a quinone-like body, besides the ordinary constituents of plants.

Rhinacanthin is a dull cherry-red resinous substance, which contains no nitrogen, and does not reduce copper solution. It seems to be related to chrysophanic and frangulic acids. Two ultimate analyses gave a mean of carbon 67·55 per cent., hydrogen 7·36 per cent. The formula $C^{14}H^{18}O^{4}$ corresponds with 67·20 C and 7·20 H. Its presence in the plant is said to be limited to certain intercellular spaces occurring in the bark, the cellular tissue of this part appearing to be filled with an intensely red substance, supposed to consist of a compound of rhinacanthin with an alkali. It is obtained by exhaustion of the powdered root fibres with absolute alcohol. Rhinacanthin has the peculiarity of forming with bases beautiful red compounds

that are easily decomposed by certain neutral solvents, such as petroleum spirit, which dissolves the rhinacanthin and assumes a yellow colour. (*Pharm. Zeitch. f. Russl.*, Feb. 1881; *Year Book of Pharm.*, 1881, p. 197.)

VERBENACEÆ.

LIPPIA NODIFLORA, *Rich.*

Fig.—*Wight Ill.*, *t.* 173 *b*, *fig.* 2, and *Ic.*, *t.* 1463; *Sibth. Fl. Gr.*, *t.* 553; *Lam. Ill.*, *t.* 17.

Hab.—Throughout India and Ceylon. The herb.

Vernacular.—Bukkan (*Hind.*), Bhúi-okra (*Beng.*), Ratolia, Vakkan (*Mar.*), Ratavalio (*Guz.*), Podútalai (*Tam.*), Bokenakú (*Tel.*).

History, Uses, &c.—According to Ainslie, the Sanskrit name is Vaśira, but the Nighantas do not mention any plant bearing this name. वशिर, with the synonym of Vasuka occurs, however, in Sanskrit literature, as the name of a plant. *L. nodiflora* is considered by the Hindus to be febrifuge and diuretic, and is administered in gonorrhœa combined with cumin seed. Locally it is applied in the form of paste to promote suppuration. The author of the *Makhzan-el-Adwiya* describes it under the name of *Bukkan* as hot and dry; he states that an infusion is useful in the febrile stage of colds, and that it is diuretic and useful in lithiasis. A poultice composed of the fresh plant is a good maturant for boils.

Ainslie has the following notice of it: "The tender stalks and leaves, which are in a slight degree bitter, the native practitioners prescribe, when toasted, in infusion, in cases of children's indigestions, to the extent of two ounces twice daily; it is also sometimes ordered as a drink for women after lying-in. The plant is a native of Southern Italy and Sicily, as well as India, and has at different times had very different appellations bestowed

on it, it being the *Blairia nodiflora* of Gærtner, the *Zapania nodiflora* of Lamarck, and the *Vervena capitata* of Forskahl. The stem is herbaceous, creeping, from 3 inches to a foot in length, sub-divided, rounded, marked with lines, and smooth. The spike is terminating, roundish, composed of small whitish or rose-coloured flowers; it has two seeds, roundish, flatter on one side than the other." (*Materia Indica,* Vol. II., p. 313.)

VERBENA OFFICINALIS, *Linn.*

Fig.—*Hayne Pl. Off.* 5, *t.* 42; *Sweet Brit. Fl. Gard. iii., t.* 202. Vervain (*Eng.*), Verveine, Herbe sacrée (*Fr.*).

Hab.—Himalaya, Bengal Plain, and Persia. The herb.

Vernacular.—Pámúkh (*Hind.*), Fáristariun or Báristariun (*Ind. Bazars*).

History, Uses, &c.—Vervain is the περιστερεών or περιστέριον of the Greeks; the word signifies "a dovecote," and the plant was so named because doves were supposed to be particularly fond of it. It was also called ἱεροβοτάνη or "holy wort," because it was used in sacrifices, purifications, and as an amulet. Dioscorides states that the leaves of the Verbena have a reputation as a local sedative and vulnerary. Pliny (25, 59) says:—"Among the Romans there is no plant that enjoys a more extended renown than *Hierabotane,* known to some persons as *Peristerion,* and among us more generally as *Verbenaca.* It is this plant that we have already mentioned (22, 3) as being borne in the hands of envoys when treating with the enemy, with this that the temple of Jupiter is cleansed, with this that houses are purified and due expiation made. There are two varieties of it: the one, that is thickly covered with leaves (*V. supina*) is thought to be the female plant; that with fewer leaves (*V. officinalis*), the male." Pliny then notices the ridiculous superstitions of the Magi in reference to the plant, and remarks that the plant bruised in wine is used as

a remedy for the stings of serpents. De Gubernatis states that Verbena was held in much the same estimation among the Romans as Kusa grass and the Tulasi plant among the Hindus. It bore numerous synonyms, such as Tears of Isis, Tears of Juno, Mercury's Blood, Demetria, Cerealis, &c. In the Middle Ages Verbena was held in high estimation by the Christian priesthood. Piperno (*De Magicis Affectibus*, Napoli, 1635) states, on the authority of Savonarola, that "Verbena manducata non permittit per septem dies coitum" It was considered to be a purifying herb which enforced chastity. In Sicily it is used as a charm to cure diseases at the present day along with fennel. The following is the prayer used in curing polypus with it:—

> Zittu, Lucia, non lacrimari,
> Scinni ni lu me ortu (come into my garden)
> Scippa pampini di brivina e finocchiu
> (Gather the leaves of Verbena and fennel)
> Ccu li to mano la chiantasti (thou hast planted it),
> Ccu li to pedi la scarpisast (thou hast trodden upon it);
> La testa di lu purpu (polypus) oci scacciasti,
> S'iddu è sangu sfissira (will melt away)
> S'iddu è purpu à mori va.

The exorciser then makes three signs of the cross on the polypus with a clove of garlic. In some parts of Piedmont the people believe that rubbing the palm of the hand at sunset with Verbena will ensure the goodwill of the first person whose hand they grasp.

In England Vervain (ferfaen) was used by the Druids in their sacred rites, and was gathered by them with much the same ceremonies as the mistletoe. In Egypt it was sacred to Isis. In Europe it has been extolled as a remedy for most diseases, but is now generally considered to have only slight febrifuge and astringent properties. Quite recently G. Ricci (*Lo Sperimentale*, 1890, Vol. LXVI., p. 483) has again drawn attention to the plant, which he states has febrifuge properties. The root is still sometimes worn as a necklace against the king's evil by the peasantry.

Mahometan physicians describe Verbena under the Arabic name of Rai-el-hamám (رعی الحمام) or as Fáristariun or Báristariun corruptions of the Greek περιστέριον. They state that it is tonic and astringent, useful in paralysis and amenorrhœa, and that a plaster of the leaves promotes the healing of wounds. An ointment is recommended for swellings of the womb, and a vinegar in skin diseases. In Persia it is called Gao-mashang and Div-mashang "fairies pea." According to Stewart, it is used as a tonic and febrifuge in the Punjab. In Cochin-China it is known as *Co-roi-ngua*, and is considered useful in nervous complaints and as a deobstruent in dropsy. (*Loureiro, Flor. Coch. Chin. i.*, p. 27.)

Callicarpa lanata, *Linn., Bedd. Anal. Pl.* 21, *f.* 6; *Wight Ill.*, *t.* 173 *b*, *f.* 5, and *Ic.*, *t.* 1480; *Rheede, Hort. Mal. iv.*, *t.* 60, is a tree of the Deccan Peninsula, the Circars, and Ceylon, which, though not noticed by Sanskrit medical writers, has a popular reputation on account of its mucilaginous and emollient properties. It is also subaromatic and bitter. Rheede states that the leaves boiled in milk are used as a wash for aphthæ of the mouth, and that the bark and root boiled in water yield a decoction which is used to lessen febrile heat and remove hepatic obstruction and herpetic eruptions. Ainslie records the use of the plant as an emollient by the Javanese and as a diuretic by the Malays. Dr. G. Watt (*Dict. Econ. Prod. Ind.*) on the authority of Dr. Trimen, states that the leaves, roots, and bark are used by the natives of Ceylon in skin diseases. *C. lanata* is from 20 to 40 feet in height, the young branches are cinnamoneous, shaggy and woolly, the leaves 4 to 8 inches long, ovate lanceolate, stellately tomentose beneath; if the tomentum is removed, numerous oil glands are visible. Both leaves and bark are faintly aromatic and bitterish, and afford much mucilage when boiled. The vernacular names are Bastra (*Hind.*), Masandari (*Beng.*), Koat-komal (*Tam.*), Iswar, Meras, Tondi-karavati (*Mar.*), Tondi-teragam (*Mal.*). Rheede states that the Portuguese call the plant *Folhas da raspa Macho*, and the Dutch *Groot Rijf-blad.*

TECTONA GRANDIS, *Linn. f.*

Fig.—*Roxb. Cor. Pl.* 1, 10, *t.* 6; *Brand For. Fl.*, 354, *t.* 44; *Bedd. Fl. Sylv.*, *t.* 250; *Rheede Hort. Mal. ix.*, *t.* 27. Teak tree (*Eng.*).

Hab.—W. Deccan Peninsula, Central India, Burmah. The wood, fruit, and tar.

Vernacular.—Sagún (*Hind.*), Segun (*Beng.*), Ság, Ságwán (*Mar.*), Tekku-maram (*Tam.*), Teku-mánu (*Tel.*), Tegu (*Can.*), Ságach (*Guz.*).

History, Uses, &c.—The teak tree is the Sáka of Sanskrit writers and the Sáj of Arabic and Persian books on Indian Materia Medica. The natives recommend a plaster of the powdered wood in bilious headaches and for the dispersion of inflammatory swellings; taken internally in doses of 90 to 200 grains it is said to be beneficial in dyspepsia with burning pain in the stomach arising from an overflow of bile, also as a vermifuge. The charred wood quenched in Poppy juice* and reduced to a smooth paste is applied to swellings of the eyelids, and is thought to strengthen the sight. The bark is used as an astringent, and the oil of the nuts, which is thick and has an agreeable odour, is used for making the hair grow and removing itchiness of the skin. (*Makhzan-el-Adwiya*, article "Sáj.") Rheede states that from the young leaves a purple dye is prepared. This colour is due to the reaction of alkalies upon a crimson body, soluble in ether, which is contained in the leaves; it forms soluble compounds with lead and baryta.

Endlicher states that the flowers are diuretic; this is confirmed by Gibson, who says that the seeds have a similar property; in two cases he saw marked diuresis follow the application of an epithem of the bruised fruit to the pubes. In the *Pharmacopœia*

* The word used in the Makhzan is *Mámitha*, an Arabic name for the Argemone of the Greeks and Romans. Two kinds of Mámitha are described by Arabic and Persian writers—one with red flowers, the other with yellow. (Conf. Dios. ii., 168, 169.) In India *Argemone mexicana* is used for Mámitha.

of India a paste made from the powdered wood is said to allay the pain and inflammation caused by handling the Burmese black varnish which is obtained from *Melanorrhœa usitatissima*. Col. Burney (*Journ. Asiat. Soc. of Bengal*, Vol. I., p. 170) has published some interesting remarks on its use. A tar is extracted from the wood, which is used as an application to the sores of draught cattle to prevent maggots breeding. As a rule white ants will not touch teakwood, and the use of teakwood tar has been suggested as a remedy against these destructive pests. The wood is also not easily affected when exposed to damp weather, and baskets for holding orchids are commonly made of teak in Burmah; while orchids are also preferably mounted on teak blocks.

At a meeting of the Nilgiri Natural History Society in 1887, Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambúr. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated (*vide* P. A. S. B., May 1870, p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa in their fissures, but principally Asan (*Terminalia tomentosa*, W. and A.), Swarm (*Zizyphus rugosa*, Lam.), Sissu (*Dalbergia Sissu*, Roxb.), and Abnus (*Diospyros melanoxylon*, Roxb.).

In 1880 Mr. V. Ball, in making a geological survey in the Central Provinces, met with this concretion, and thus alludes to it in his "*Jungle Life in India*": "Some white marks on the cut stumps of an Asan tree caught my eye, and these on examination proved to be sections or laminæ of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces seven inches long by two inches thick were

met in the trunks at a height of about six feet from the ground. By the natives the lime is burnt and used for chewing with *pan.* On examination it was found there was no structure in these masses, which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood and seemed to be cemented together by the lime."

. Major-General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "*Forestry of Southern India*": "It is a curious fact that in the Wynaad though there is no free lime in the soil, yet Teak (*Tectona grandis*) and Blackwood (*Dalbergia latifolia*), if wounded near the ground, contrive to absorb large quantities of lime. It may be seen encrusting the tree on the surface as far as four feet in height, from three inches to a foot in width, and two or three inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel."

Description.—Trunk erect, growing to an immense size; bark ash-coloured and scaly; branches numerous, spreading; young shoots 4-sided, sides channelled; leaves opposite, petioled, spreading, oval, a little scalloped, above scabrous, below covered with whitish rather soft down, they are larger at a distance from the flowers, and on young trees, *viz.*, from 12 to 24 inches long and from 8 to 16 broad; petioles short, thick, laterally compressed; panicles terminal, very large, cross-armed, divisions dichotomous, with a sessile fertile flower in each cleft, the whole covered with a hoary, farinaceous substance; peduncles common, quadrangular, sides deeply channelled, angles obtuse; bracts opposite, lanceolate, two at each sub-division; flowers small, white, very numerous; calyx and corolla oftener six than five cleft; nectary very small, frequently wanting, stamens often six; germ superior, round, hairy, 4-celled, with one ovule in each attached to the axis; stigma 2-cleft, divided, obtuse, spreading; drupe within the enlarged, inflated, dry calyx obtusely 4-sided, woolly, spongy dry; nut exceedingly hard, 4-celled. (*Roxb.*) The wood has a peculiar aromatic odour. The tar obtained from it is black and opaque when properly made, but

when prepared from partly dried wood it is mixed with the sap and forms a greyish brown emulsion. The seeds are of the size and shape of Sesamum seeds; they are very oily, but the difficulty of extracting them from the nuts would make the oil very expensive; it is a bland, fatty oil, free from any peculiar odour.

Chemical composition.—Abel in 1854 showed that the wood of teak frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, $Ca\,H\,PO_4$, H_2O, with about 11·4 per cent. ammonio-magnesium phosphate. (*Chem. Soc. Qu. J. xv.*, 91.)

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate $Ca\,H\,PO_4$ (*Landw. Versuchs. St.* xxii., 68; xxiii., 413.) More recently still Professor Judd has found in teak a specimen of crystalline apatite, a well-known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case, as the ash of teakwood is composed as follows:—

CaO	MgO	FeO	K_2O	Na_2O	SiO_2	SO_3	P_2O_5	CO_2	Cl
31·35	9·74	0·80	1·47	0·04	24·98	2·22	29·69	0·01	0·01

The percentage of carbon and hydrogen are higher than in most woods, and this, together with the richness in calcium phosphate and silica, may perhaps account for the great hardness of teak." (*Watts' Dict. Chemistry*, 3rd *Suppl.*, p. 1894.)

Mr. D. Hooper says:—"The sample from Nilambúr was in the form of a rounded flattened cake about ten inches in diameter and two or three inches in thickness; dirty white in colour, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition

similar to prepared chalk, with a dark-coloured gummy matter, and a small quantity of crystalline quartz sand. The following is the composition:—

Calcium carbonate	70·05
Tricalcic orthophosphate	2·89
Quartz sand	9·76
Organic matter	14·30
Moisture	3·00
	100·00

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees might show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rains to which this district is subjected would scarcely leave anything soluble on the trees.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full-sized cinchona tree contains about 10 ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to

render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit." (*A paper read at a Meeting of the Nilgiri Natural History Society, Ootacamund, November 7th*, 1887.)

Teak wood yields on distillation with water an opalescent distillate impregnated with resinous matter, but no trace of essential oil could be obtained when operating with 126 lbs. of fresh sawdust from Indian teak. For the extraction of the tar two earthen pots were used luted together; the upper with a perforated bottom contained the wood in chips; the product was a rather liquid black tar having much the odour of coal tar. One pound of the sawdust exhausted with alcohol yielded a resinous extract, which, after having been well washed with hot water, weighed half an ounce; the resin is black, and has the peculiar odour of the wood.

The late R. Romanis (*Jn. Chem. Soc.*, 3-11-87) found that alcohol extracts a soft resin from teak wood, but no oil or varnish. On distilling the resin he obtained a crystalline substance which he also found to be present in considerable quantity in the tar resulting from the destructive distillation of teak. The analyses which he has made of the crystals point to the empirical formula $C^9 H^{10} O$; on oxidation with nitric acid they yield what appears to be a quinone of the formula $C^{18}H^{16}O^2$.

PREMNA INTEGRIFOLIA, *Linn.*

Fig.—*Wight Ic., t.* 1469; *Rumph. Herb. Amb. iii., t.* 134.

Hab.—Coasts of India from Bombay to Malacca, Silhet, and Ceylon. The leaves and root.

Vernacular.—Arani, Ganiari (*Hind.*), Bhut-bhiravi (*Beng.*), Munni (*Tam.*), Ghebu-nelli, Pinna-nelli (*Tel.*), Arani (*Mar.*), Takkilé, Taggi (*Can.*), Mothi-arani (*Guz.*).

History, Uses, &c.—This shrub, in Sanskrit Arani, Harimantha, Agni-mantha, and Vahnimantha, "producing fire by friction," is so named on account of its wood being one of those used to obtain the sacred fire. Gamble states that in Sikkim the hill tribes habitually make use of the wood of *P. latifolia* and *P. mucronata* for obtaining fire. Of the two pieces of wood used by the Hindus for this purpose, the lower or soft wood is called in Sanskrit Adharárani, and the upper or hard wood, with which friction is made, is called the Pramantha; they are considered to be symbolical of the Yoni and Upastha (organs of generation).

In the Nighantas Arani is described as hot, an expellant of phlegm and wind.

Its root is one of the ingredients of the Dasamula, and the leaves are a popular remedy in the exanthematous fevers. Ainslie states that the root has a warm bitter taste and agreeable smell, and is prescribed in decoction as a gentle cordial and stomachic in fevers. Rheede calls the plant *Appel,* and notices the use of a decoction of the leaves for flatulence. Ainslie also remarks that it is the *Folium hirci* of Rumphius and that Burman calls it *Cornutia corymbosa* and Herman *Sambucus odorata aromatica.* In Ceylon it is known as *Maha-midi* or *Midi-guss.* Atkinson states that the leaves rubbed with pepper are administered in colds and fevers, and that externally a decoction of the whole plant is used in rheumatism and neuralgia.

Description.—A large shrub or small tree, blossoming in the rainy season. Trunk short; branches numerous, often procumbent and rooting; bark smooth, dark brown, leaves opposite, petioled, cordate, serrate on the anterior margins, acute pointed, smooth on both sides, from 1 to 6 inches long and from 1 to 3 inches broad; flowers in corymbs, terminal or between two branchlets, primary divisions opposite, the last 2-forked, flowers minute, numerous, of a pale greenish-white; berries black, the size of a pea. The plant has an agreeable aromatic odour and an acidulous and astringent taste.

Chemical composition.—The root-bark of this plant afforded a yellowish-brown powder giving an orange-brown tincture with alcohol. The tincture when evaporated left a reddish-coloured tasteless resin and some extractive matter. The resin was soluble in ether and in alkaline liquors; from the latter solution it was precipitated in greyish-brown flocks by acids. Warmed with soda, the resin evolved an odour of lemon similar to that of Kamala resin; heated with sulphuric acid a transient purple colour was developed and a fragrant odour evolved. It showed no disposition to crystallize. The watery solution of the alcoholic extract had a sweetish taste in small quantities and was nauseous in larger quantities. It contained a bitterish amorphous alkaloid, a substance reducing Fehling's solution, and an astringent body, striking a green colour with ferric chloride, but giving no precipitates with gelatine. The alkaloid gave no distinct colour reactions with the strong mineral acids.

PREMNA HERBACEA, *Roxb.*

Fig.—*Griff. Ic., t.* 447, *lower figure*; *Ferguson, Pamphl.*, Colombo, 1887.

Hab.—Sub-tropical Himalaya and South Deccan Peninsula. The root.

Vernacular.—Bhárangi (*Hind.*), Bámanháti (*Beng.*), Shirutek (*Tam.*), Gandu-bárangi (*Tel.*), Bháranga-múla (*Mar.*), Gantu-bhárangi, Náyityága (*Can.*), Kanta-bháranni (*Mal.*), Barang (*Guz.*).

History, Uses, &c.—This plant is frequently confounded with *Clerodendron serratum*, Spreng., the roots and stems of which are sold under the name of Bhárangi. In Sanskrit Bhárangi bears the names of Bhárgi, Brahmayashtika, Hangika, Bringa-ja, and Vardhaka, and is described in the Nighantas as hot, bitter, pungent, and digestive; a remover of dropsy, cough, phlegm, asthma, fever, and rheumatism. The juice of the root is given with the juice of ginger and

warm water in asthma, and it enters into the composition of several compound decoctions for diseases of the lungs. A confection called *Bhárgi-guda* is prepared with a decoction of the root, and the ten drugs called *Dasamula,* chebulic myrobalans, treacle, and aromatics. An oil prepared with the root is recommended for external application in the marasmus of children. (*Chakradatta.*)

The properties of *P. herbacea* agree much more nearly with those attributed to Bhárangi in the Nighantas, than do those of *Clerodendron serratum,* although the latter plant is at the present time in use as Bhárangi throughout the greater part of India. Dutt attributes the drug to *C. Siphonanthus,* but the samples we obtained from Bengal consisted of the stems of *C. serratum.* Bombay was formerly supplied from the Circars with *P. herbacea,* but now uses *C. serratum.* Although the root of *P. herbacea* has been known from ancient times, it is only within the last few years that its botanical origin has been identified. It was exhibited at the Madras Exhibition of 1855, under the name of Gantu Bhárangi, among several chemical and pharmaceutical products. It is mentioned in Sir Walter Elliot's *Flora Andhrica,* published in 1859, and referred to an unknown species of Clerodendron, which, he says, might be called *acaulis;* the plant is there said to grow about Lammasingi to the west of Vizagapatam, whence it is exported to Madras and Bombay to the amount of several thousand rupees yearly.

W. Ferguson in 1861 identified the Gantu Bhárangi of Southern India with *P. herbacea,* and in a pamphlet published at Colombo in 1887 gave a figure of the plant and its root.

Description.—A small undershrub; flowering branches 1—4 inches, springing up after the jungle fires. Leaves 4 by 2—3 inches, obtuse, mature microscopically dotted above, minutely deciduously pubescent beneath, nerves 5 pair. Corymbs 1½ inch in diameter, pubescent, somewhat dense; peduncle 0—1½ inch. Calyx $\frac{1}{10}$ inch, closely pubescent; lobes ovate, obtuse. Corolla $\frac{1}{8}$ inch, greenish-white, hairy in the throat, 4-lobed, obscurely 2-lipped. Drupe ¼ inch in diameter,

globose. Roots about as thick as a crowquill with numerous almost globular woody knots.

Chemical composition.—The constituents of this root resemble to a great extent those found in *P. integrifolia.* An orange-brown acid resin soluble in ether, alcohol and alkaline solutions, and traces of an alkaloid are the most important. There is a quantity of starch in the root, and an entire absence of astringency.

Premna tomentosa, *Willd., Wight Ic., t.* 1468, Naguru-chettu (*Tel.*), Pedanganeree, Kollay-cottaynellay (*Tam.*), is used medicinally in Southern India. Dr. P. S. Mootooswamy states that the leaves are diuretic, and are given internally and applied externally in dropsy. An infusion of 10 drachms of the leaves and 2 drachms of coriander in ten ounces of boiling water has been used by him with advantage in acute dropsies.

Dr. Mootooswamy has seen the natives using the leaves soaked in goat's urine or in onion juice for dropsy; sometimes chebulic myrobalans are added if the bowels are costive.

GMELINA ARBOREA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 246; *Wight Ic., t.* 1470; *Bedd. Fl. Sylv., t.* 253; *Rheede, Hort. Mal. i., t.* 41.

Hab.—Deccan Peninsula, and Ceylon to N.-W. Himalaya. The root and fruit.

Vernacular.—Kambhári, Gumhár, Shevan (*Hind.*), Gámári (*Beng.*), Shivani, Shevana (*Mar.*), Shivannigida (*Can.*), Gumadi (*Tam.*), Gumar-tek, Peddagomru (*Tel.*), Kumbulu (*Mal.*), Shewan (*Guz.*).

History, Uses, &c.—In the Nighantas this tree bears the Sanskrit names of Ghambhári, Sriparni, Kásmari, &c. The root is described as bitter, tonic, stomachic, laxative, and useful in fever, indigestion, anasarca, &c. It is an ingredient of the Dasamula, or "ten roots," and is therefore much used in a variety of diseases. Bangasena says that Gambhári root taken with

liquorice, honey, and sugar increases the secretion of milk. The fruit is bitter-sweet and cooling, and enters into the composition of several cooling decoctions which are recommended for fever.

The following is an example: Take of the fruits of *G. arborea* and *Grewia asiatica* (parushaka), liquorice root, red sandal wood, and the root of *Andropogon muricatus* (ushira), equal parts, in all two tolás (360 grains), water thirty-two tolás, and boil till reduced to one half. (*Chakradatta*, quoted by Dutt, *Hind. Mat. Med.*, p. 218). The juice of the young leaves is used as a demulcent in gonorrhœa, cough, &c., alone or with other demulcents (*Pharmacopœia of India*, p. 164). The bark of the tree is used by arrack manufacturers in the Madura district to regulate the fermentation of toddy.

The wood of this tree on account of its lightness and toughness is much valued for carriage-building and all ornamental work; it is light yellow with a reddish heart wood, close and even-grained, easily worked, and readily takes paint or varnish. At the Government Medical Store Depôt Workshops it has been found to be the best wood for making artificial limbs, stethescopes, &c. It turns well. Weight 30 to 40 lbs. per cubic foot.

Description.—An unarmed tree, sometimes attaining 60 feet, deciduous, flowering with the young leaves. Leaves 9 by 6 inches, more or less acuminate, entire, mature glabrate above, stellately hairy beneath; petiole 3 inches, top glandular. Panicles often one foot in length, terminal; bracts $\frac{1}{8}$ inch; flowers numerous. Calyx $\frac{1}{6}$ inch, teeth very small or obsolete. Corolla brownish-yellow, upper lip shortly bifid, longer than the lower. Drupe $\frac{3}{4}$ inch, ovoid, usually 2 to 1 seeded. The roots have a light brown bark and yellowish wood, which is light and tough; they have a bitterish mucilaginous taste. The fruit is bitter-sweet and mucilaginous.

Chemical composition.—The root reduced to fine powder lost 8·39 per cent. at 100°C. The ash amounted to 14·41 per cent., and was free from any trace of manganese.

On analysis the following results were obtained :—

Petroleum ether extract	......	1·80 per cent.
Ether ,,	......	·21 ,, ,,
Alcoholic ,,	......	4·274 ,, ,,
Aqueous ,,	...	19·560 ,, ,,

The petroleum ether extract consisted of a yellow viscid oil, with slight siccative properties. On standing, white grains separated, which were non-crystalline when examined microscopically. In alcohol the extract was partly soluble: no alkaloid was present. The ether extract was yellowish-white, and contained a trace of oil; it gave no reaction with ferric salts: in addition to resins a trace of benzoic acid was present.

The alcoholic extract was yellow and brittle: with water a turbid mixture was obtained, which had a bitter taste. In addition to resins a trace of an alkaloidal principle was detected.

The aqueous extract was sweetish and slightly bitter, and easily reduced Fehling's solution on boiling.

The fruit contained butyric acid, with a trace of tartaric acid, a trace of astringent matter giving a greenish coloration with ferric chloride, an alkaloid, and a white principle, non-crystalline, and neutral, with resin and saccharine matter.

The alkaloids present in the fruit and in the root appear to be identical. The amount present in each case was very small, not exceeding a trace.

Several species of Gmelina are sometimes used as demulcents.

G. asiatica affords the *Radix Deiparæ* or *Rais madre de Deos* of the Portuguese. Rumphius (*Hort. Amb.*, i., p. 129) relates that formerly its roots were dug only on St. Mary's day, and that only those roots which turned towards the north were selected for use. It was in great request in Goa as an antidote to every poison, and a remedy for every disease in former days. The roots are slightly bitter, astringent, and aromatic. Loureiro says:—"Valent in doloribus articulorum, et affectibus nervorum, radix interne sumpta; folia externe applicata." (*Flor. Cochin-Chin.*, ii., p. 376.) The Tamil name

is *Nilacúmal*, and the Telugu *Nela-gúmádi*. (*Ainslie, Mat. Ind.*, ii., p. 240.)

VITEX NEGUNDO, *Linn.*

Fig.—*Wight Ic.*, *t.* 519; *Rheede, Hort. Mal. ii.*, *t.* 12.

VITEX TRIFOLIA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 2187; *Rheede, Hort. Mal. ii.*, *t.* 11.

Hab.—Throughout India and Ceylon. The leaves, root, and fruit.

Vernacular.—Sambhálu, Nisinda (*Hind.*), Nisinda (*Beng.*), Vanai, Nigudi, Lingur (*Mar.*), Vellai-nochi, Nir-nochi (*Tam.*), Tella-vávili, Niru-vávili (*Tel.*), Nochi, Nirnochi (*Mal.*), Lakki, Karé-lakki (*Can.*), Niguri (*Guz.*).

History, Uses, &c.—These two shrubs, the properties of which appear to be identical, are described by Sanskrit writers under the names of Nirgundi, Sindhuvára,* Sephálika, Sveta-pushpi, Pushpaníllika, &c. Two varieties are recognised: one with pale blue flowers (*Svetapushpi*), and the other with blue flowers (*Pushpanílika*). Among the Tamils, one of these plants is supposed to be male and the other female, and for this reason they are usually combined together in their prescriptions. In the Nighantas, Nirgundi is described as cephalic, pungent, astringent, bitter and light; a remedy for colic, swellings, rheumatism, worms, leprosy, dyspepsia, phlegm, and boils.

The leaves are generally used as a discutient fomentation in sprains, rheumatism, swelled testicles, contusions, &c. The root is thought to be tonic, febrifuge, and expectorant, and the fruit nervine, cephalic, and emmenagogue.

Mahometan physicians use these plants as substitutes for *Vitex Agnus-castus*, the fruit of which is imported into India and sold in the bazars as Sambhálu-ke-bij.

* Sinduka, Sinduvára or Syandavára, from being used to prevent a flow of humours, is probably more correct.

V. Negundo is the Lagondium of Rumphius, who states that the leaves are used to preserve rice and clothes from insects and to drive them away; and that the Javanese women make an extract from it which they use as a carminative and emmenagogue. In India the leaves are often placed between the leaves of books to preserve them from insects.

V. trifolia, Linn., is highly extolled by Bontius. (*Diseases of India*, p. 226.) He speaks of it as anodyne, diuretic, and emmenagogue, and testifies to the value of fomentations and baths prepared with 'this noble herb,' as he terms it, in the treatment of Beri-beri, and in the allied and obscure affection, burning of the feet in natives. Of *V. Negundo*, Fleming remarks (*Asiat. Researches*, Vol. XI.) that its leaves have a better claim to the title of discutient than any other vegetable remedy with which he is acquainted. The mode of application followed by the natives is to put the fresh leaves into an earthen pot and heat them over the fire till they are as hot as can be borne without pain; they are then applied to the affected part, and kept *in situ* by a bandage; the application is repeated three or four times a day until the swelling subsides. Pillows of the dried leaves are sometimes used to lie upon for cold in the head and headache. Dr. Hové (1787) states that the Europeans in Bombay call it the fomentation shrub, and that it is used in the hospitals there as a foment in contractions of the limbs occasioned by the land winds. In the Concan the juice of the leaves with that of Máká (*Eclipta alba*) and Tulasi (*Ocimum sanctum*) is extracted, and Ajwán seeds are bruised and steeped in it, and given in doses of six *massas* for rheumatism. The juice in half tolá doses with ghi and black pepper is also given, and in splenic enlargement 2 tolás of the juice with 2 tolás of cow's urine is given every morning. A very interesting account of the treatment of febrile, catarrhal, and rheumatic affections, as practised by the people of Mysore, by means of a sort of rude vapour bath prepared with this plant, is furnished by Dr. W. Ingledew. (*Edin. Med. and Surg. Journ.*, Oct. 1817, p. 530.) Roxburgh mentions the use of baths prepared with the aromatic leaves in

the puerperal state of women in India. According to Ainslie, the Mahometans are in the habit of smoking the dried leaves in cases of headache and catarrh. The dried fruit is deemed vermifuge. (*Phar. of India*, p. 163.)

Description.—A shrub growing in patches; branchlets, panicle, and underside of the leaves white, with a fine tomentum; leaves petioled, 3 to 5 foliolate; leaflets lanceolate, long, acuminated, entire, or coarsely cut and crenated; panicle terminal, pyramidal; flowers bluish-white to blue; berry black, the size of a pea. The habit of the shrub is variable; when growing near the sea it has almost always 3-foliolate entire leaves, the leaflets being attenuated into the petioles; inland, the shrub has a more delicate appearance; the petioles of the leaves are much longer and the leaflets, from 3 to 5 in number, are often serrated. The serrated variety is preferred for medicinal purposes, and is called *Kátrí*. The leaves of both varieties appear to be equally aromatic; the odour reminds one of the English Bog Myrtle (*Myrica Gale*, Linn.); the taste is bitter and nauseous. The berry is very feebly aromatic. In Anthony Collin's French Translation of Clusius, Lyons, 1602, there are figures of both plants, which, though old and quaint, represent the general appearance very fairly.

Chemical composition.—The leaves contain principally an essential oil and a resin. The oil possesses the odour of the drug and is neutral and almost colourless. The resin dissolves in alkaline solutions with a reddish-brown colour, softens below 40° C., and gives off aromatic vapours when heated. A tincture of the drug gives a green colour with ferric chloride. The ash of the air-dried leaves amounts to 7·75 per cent.

The fruits contain an acid resin, an astringent organic acid giving a green colour with ferric salts and a precipitate with gelatine, malic acid, traces of an alkaloid and colouring matter. The fruits previously dried at 100° gave 6·8 per cent. of ash.

Vitex Agnus-castus, *Linn.* Mahometan physicians, under the Arabic name of Athlak and the Persian Panjangusht,

describe the ἄγνος of the Greeks and the Vitex of the Romans. The berries under the names of Hab-el-fakad and Sambhálu-ke-bij are imported into India and are considered to be astringent, resolvent, and deobstruent, and useful for removing obstructions of the brain and liver; they are also given for enlargement of the spleen and dropsy. *V. Agnus-castus* is also called by the Arabs Zu-khamsata aurák, "the five-leaved," and in Egypt is known as Kaf Miryam, "the hand of Mary." Among the ancients it was sacred to Esculapius, and was considered symbolical of chastity. In the Middle Ages the fruit was known as "Monks' pepper." The fruit is sold in Bombay as *Rénuka*, the true rénuka (*Piper aurantiacum*) is not known in Western India.

Description.—A small, dull gray, ovoid fruit, the size of a duckshot, half enclosed in the calyx, to which a portion of the peduncle remains attached. Upon section it is found to be extremely hard, and, if perfect, to consist of four cells, each containing a small flat seed. Generally one or more of the cells are abortive.

Chemical composition.—The seed of *V. Agnus-castus* has been found to contain a peculiar bitter principle called *Castine,* a volatile acrid substance, a large quantity of free acid and fat oil. In Greece the fresh and rather unripe berries are said to be added to the must of the grape to render the wine more intoxicating, and prevent it from turning sour. (*Landerer, Buchn., Repert. liv.,* 20; LXXXI., 229; *Buchn. N. Repert.,* III., 392.)

CLERODENDRON INERME, *Gärtn.*

Fig.—*Gärtn. Fruct. I., t.* 57, *f.* 1; *Rheede, Hort. Mal. v., t.* 49.

Hab.—India and Ceylon, near the sea. The leaves.

Vernacular.—Sangkupi, Chhoti-arni (*Hind.*), Isamdhári (*Dukh.*), Shen-gankuppi (*Tam.*), Pishinika, Utichettu (*Tel.*), Banjoi (*Beng.*), Koivel, Vanajai, Lahán-khári-narvel (*Mar.*), Naitakkilé (*Can.*).

History, Uses, &c.—This is a shrub the medicinal properties of which are widely known in the East. Some identify it with the Kshudrágnimantha of the Rája Nirghanta. It is the *Gambir-laut* of Java, the *Wœl-bu-rœnda* of Ceylon, and the *Sanfu-mun* of Cochin-China. Ainslie says the juice of the leaves and root is considered alterative in scrofulous and venereal affections, the dose being a tablespoonful with or without a little castor oil. Rheede speaks of the use of the dried leaves for the same purpose, and of a poultice of the leaves to resolve buboes; he also says a bath prepared with them is used in mania, while the root boiled in oil affords a liniment useful in rheumatism. *C. inerme* is the *Jasminum litoreum* and *Pharmacum litoreum* of Rumphius (*Lib.* vii., cap. 47), who says the Amboyna name is *Wale-puti-lohaha*, which means "white strand cord." The Malays and Macassars administer the berries or the root to people poisoned by eating unwholesome fish; the leaves smeared with oil are heated over the fire and applied to recent wounds; they are also one of the leaves used for preparing the green rice of the Malays; he concludes by saying "larga ac fausta natura in cunctis fere litoribus hanc obviam profert plantam." In Bombay the plant has a great reputation as a febrifuge; the juice of the leaves is used in doses of half an ounce. It is mucilaginous, very bitter, somewhat saline, and with a fragrant, apple-like odour.

The medicinal properties of *C. inerme* closely resemble those of Chiretta. The dried leaves have been found to be quite as efficient as the juice of the fresh plant; they should be dried in the shade to preserve their aroma, and may be administered in decoction with aromatics, or powdered and made into pills. A tincture has also been found to be an efficient preparation.

Description.—A straggling shrub, 3—7 ft.; shoots grey-pubescent. Leaves opposite, rarely ternate, $\frac{3}{4}$—$1\frac{1}{2}$ in., when young somewhat grey-pubescent, base cuneate; petiole $\frac{1}{8}$ in. Peduncles $\frac{1}{2}$—$1\frac{1}{2}$ in., all axillary, 3—7 fid.; bracts $\frac{1}{30}$ in., linear; pedicels $\frac{1}{8}$—$\frac{1}{6}$ in., calyx grey-puberulous or glabrate. Corolla white, tube $\frac{3}{4}$ in., glabrate, lobes $\frac{1}{3}$ in., oblong. Drupe $\frac{1}{2}$ by $\frac{1}{3}$ in.,

spongy, hardly succulent, smooth, hardly sulcate, separating into four woody pyrenes. Or the leaves may be mostly ternate or sublinear and larger. The drupe also may vary in size. Some on this account make Rumphius' plant a separate species under the name of *C. neriifolium*, but Bentham and Kurz consider it only a variety.

Chemical composition.— A proximate analysis of the leaves gave the following results:—

Ethereal extract	4·77
Alcoholic "	5·70
Aqueous "	15·54
Alkaline "	11·48
Organic residue	50·06
Inorganic "	6·44
Moisture "	6·01
Total	100·00
Ash soluble in water	44·14
" " in acid	47·10
Sand and silicates	8·76
Total	100·00
Sodium chloride in ash	24·01

The bitter principle is entirely removed by ether, and the subsequent treatment by alcohol and water affords extracts which are free from any bitterness. Ether, alcohol, and water independently exhaust the leaves of this principle, but the former removes it with less admixture of foreign substances. The ether extract evaporated and mixed with water will give up the bitter property to the solvent, and this by gradual evaporation leaves it in an almost pure condition. It is obtained as a viscid mass, which, in process of time and by exposure to the air, hardens, and may be reduced to a non-hygroscopic powder. It is soluble in water, with a slightly acid reaction, and is partially rendered insoluble by neutral plumbic acetate, thus giving evidence of its compound nature. The portion precipitated by the lead salt, when liberated from the metal by hydrogen sulphide, was a

light-coloured amorphous acid powder, soluble in water, spirits of wine and ether, and reducing Fehling when in aqueous solution. The bitter principle that escaped precipitation by plumbic acetate was readily shaken out of the acid filtrate with ether. This was a whitish amorphous powder soluble in water, with a neutral reaction, and did not reduce Fehling's solution; it was not precipitated by alkalies, and was not coloured with ferric chloride; it was chiefly distinguished by its being precipitated by tannin and affording a transient red-brown colour with strong sulphuric acid. The dual nature of the bitter principle seems to show a very remarkable resemblance with that found in Chiretta (*Swertia Chirata*), a gentianaceous plant. Chiretta has been investigated by Höhn, who found the drug to contain *Ophelic acid* $C^{13} H^{20} O^{10}$ and *Chiratin* $C^{26} H^{48} O^{15}$, an acid and neutral bitter principle respectively, and representing the activity of the herb.

The leaves, when distilled with water, yield a stearopten-like body having the fruity flavour of the fresh plant. The ether extract was fragrant, green, and of a greasy consistence. The alcoholic extract contained some resinous matter, and much of the salt, which was left as cubical crystals when evaporated. Water dissolved out gum and brown colouring matter. Neither tannin nor starch was present in the leaves. They left on gentle incineration as much as 15·29 per cent. of ash, and the large amount of salt in this ash indicates the habitat of the plant as being in close proximity to the sea. (*Hooper in Pharm. Record*, Aug. 1st, 1888.)

CLERODENDRON INFORTUNATUM,
Gärtn.

Fig.—*Rheede, Hort. Mal. ii., t.* 25; *Burm. Zey., t.* 29.

Hab.—Throughout India. The leaves.

Vernacular.—Bhánt (*Hind.*), Bhat (*Beng.*), Chitu (*Nepal*), Bhándir, Kari (*Mar.*), Karé (*Can.*).

History, Uses, &c.—Rheede states that the leaves of this plant are used as a vermifuge, and that the root rubbed down with

buttermilk is administered in colic and lientery. Dr. Bholanath Bose has drawn attention to the leaves as a cheap and efficient substitute for Chiretta. (*Pharmacopœia of India.*) Brigade-Surgeon J. H. Thornton considers the expressed juice of the leaves to be an excellent laxative, cholagogue, and anthelmintic; also a valuable bitter tonic, and useful as an injection into the rectum for the destruction of ascarides. These opinions are supported by those of six other medical officers quoted by Dr. G. Watt in the *Dictionary of the Economic Products of India*, ii., p. 373. M. C. Dutt gives Bhándira as the Sanskrit name, but this name does not occur in the Rája Nirghanta, and is usually applied to other plants. In Western India it has been identified with the Kári of the Rája Nirghanta.

Description.—A gregarious shrub spreading by underground suckers, 3 to 6 feet in height. The leaves are from 8 to 10 inches long, and from 7 to 8 inches broad at the base, ovate-cordate, hairy on both sides, odour disagreeable, taste bitter, and slightly astringent. The inflorescence forms large, terminal, cross-armed panicles, flowers white, streaked with pink, sweet-scented; after they have fallen, the calyxes enlarge and turn red.

Chemical composition.—A proximate analysis of the leaves gave the following result:—

Ethereal extract	10·81
Alcoholic "	16·40
Aqueous "	15·20
Alkaline "	8·97
Organic residue	38·47
Inorganic "	5·93
Moisture	4·22
Total......	100·00

Ash soluble in water	16·83
" " in acid	72·86
Sand and silicates	10·30
Total......	100·00
Sodium chloride in ash	5·58

The leaves of *C. infortunatum* were devoid of the odorous principle noticed in the former species, and yielded no volatile constituent when boiled with water. The ether extract contained a quantity of resinous matter, and gave up the bitter principles when heated with water; the extract was of a less fatty consistence than that from the *C. inerme* leaves. The spirituous extract was also much larger than in the previous sample, and was differently constituted, inasmuch as it almost entirely consisted of a tannin, giving a green colour with ferric chloride. These leaves contain much more soluble organic matter than the former, but the percentage composition of the ash shows that the soluble inorganic salts are much smaller. The ash of these leaves amounted to 12·3 per cent. (*Hooper in Pharm. Record*, Aug. 1st, 1888.)

Clerodendron Siphonanthus, *Br., Lam. Ill., t.* 79, *f.* i.; *Wight Ill., t.* 173, is stated by M. C. Dutt to be in use in Bengal as Bhárangi, but the samples of that drug which we obtained from Calcutta and Cawnpore proved to be the stems and roots of **C. serratum**, *Spr., Wight Ic., t.* 1472; *Bot. Mag., t.* 2536. From enquiries we have made there is no doubt that the latter plant is largely used in many parts of India as a substitute for *Premna herbacea*, the true Gantu Bhárangi, but if we regard the root of *C. serratum* as the true Bhárangi, and the root of *P. herbacea* as the Gantu (or knotted) Bhárangi, there will be no confusion. *C. serratum* has a light-coloured root, very often contorted, and seldom more than an inch in diameter. A light brown epidermis and thin bark cover the tough woody portion, which shows well-marked medullary rays and concentric rings. The drug contains much starch, it is faintly bitter, and has no peculiar odour. The young tops and light blue flowers are used as a vegetable by the natives.

The root of *C. serratum* did not yield anything of great activity when examined chemically, which proves that there is little to recommend it as a medical agent. The wood of the root is almost inert and tasteless; the thin bark constitutes only one-fifth of the weight of the dried root and contains a small

quantity of the peculiar bitter principles, dissolved by ether, associated with an acrid resinous substance, and some fatty material. It is interesting to observe, however, that the reactions of the bitter principle, although occurring in such small quantity, were identical with that obtained in the leaves of the other two species, where it formed from ½ to 1 per cent. of the total.

AVICENNIA OFFICINALIS, *Linn.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 271; *Wight Ic., t.* 1481; *Rheede, Hort. Mal. iv., t.* 45. The White Mangrove (*Eng.*), Palétuvier blanc (*Fr.*).

Hab.—Mangrove swamps of Deccan Peninsula and Ceylon. The seeds and bark.

Vernacular.—Bani (*Beng.*), Mada-chettu, Nalla-mada (*Tel.*) Upputi (*Mal.*), Tivara (*Mar.*), Timmar (*Sind*).

History, Uses, &c.—This plant derives its generic name from the celebrated Arabian physician Avicenna (Ibn Sina). The green fruit mixed with butter and boiled is made into a plaster, which is used for softening and maturing tumours, and to promote the healing of the ulceration caused by small-pox. This property of the fruit is alluded to by Camoens in the "Lusaid"—

> "Wide forests there beneath Maldivia's tide
> From withering air their wondrous fruitage hide.
> The green-hair'd Nereids tend the bowery dells,
> Whose wondrous fruitage poison's rage expels."

The bark is astringent and is used by tanners. In Madras the ashes of the wood are used by washermen for washing clothes. The wood is valued on account of its durability under water, and as a fuel for heating furnaces it is preferred to other kinds of wood on the West Coast of India. The seeds are bitter, but are sometimes eaten.

Description.—A shrub or tree with opposite evergreen leaves, which are oblong, entire, and covered beneath with a white pubescence. The flowers are arranged in closely-packed

terminal bunches, and are of a dirty yellow colour. The fruit is a broad, compressed capsule, one inch in length, dehiscing by two thick valves; seed erect, cotyledons large, plaited lengthwise, radicle inferior, villous. The roots stand out of the mud in which they grow, overarching each other in erect angled masses, and send up asparagus-like shoots from their underground parts.

Chemical composition.—The bark of *A. officinalis* is used in Madras as a dyeing agent rather than as a tan. It contains a red colouring matter striking a greenish colour with ferric chloride, but giving no precipitate with gelatine. The colouring matter is precipitated by acids and redissolved by alkalies. The ash of the air-dried bark amounts to 11·4 per cent., and is deliquescent.

LABIATÆ.

OCIMUM BASILICUM, *Linn.*

Fig.—*Wight Ic., t.* 868; *Jacq. Hort. Vind. iii., t.* 72; *Rheede, Hort. Mal. x., t.* 87. Sweet Basil (*Eng.*), Grand Basilie (*Fr.*).

Hab.—Persia, Punjab. Cultivated throughout India. The herb and seeds.

Vernacular.—Názbo, Sabza (*Hind.*), Sabja (*Mar., Guz.*), Násbo, Sabja, Baboi-tulsi (*Beng.*), Tirunitru-pachchai (*Tam.*), Vibudi-pattri (*Tel.*), Kam-kasturi (*Can.*).

History, Uses, &c.—The Hindus dislike the smell of this plant; the Mahometans on the other hand are very partial to it. The Arabs call it Rihán or "the herb," and the Persians Shahasperham or "king of herbs," and Názbu, "having a delicate odour"; it is also known in Persia as Habak-i-Kirmáni, "Kirman mint," from its abundance in that province. The author of the *Makhzan* states that it is the اسيم (Ocimum) of

Europeans, who call the large-leaved variety *Ocimum magnum*, and the small-leaved *Ocimum parvum*. The plant is considered to be hot and dry, deobstruent, carminative, and stimulant, and the seeds taken whole are much valued on account of their mucilaginous properties: when crushed they are said to be astringent, and are prescribed in fluxes from the bowels. The juice of the plant snuffed up causes sneezing and clears the brain. *O. basilicum* is probably the ὤκιμον of Dioscorides, but perhaps not of Theophrastus, who describes ὤκιμον as a shrub. The Ocimum of Pliny is probably a kind of clover which also bore this name, as he states that it is given to mares and asses to promote conception.

De Gubernatis (*Myth. des Plant*, ii., 35) gives an interesting account of the history of Basil in Europe where it is considered to be erotic and funereal. In Southern Italy it is worn in the waist or bosom of young girls and in the hair of married women, and is called *Bacia-nicola;* the youths stick a sprig of it above the ear when they go courting. In Tuscany the Basil is called *Amorino.* In Crete it is a sign of mourning, but is universally cultivated in window gardens; Boccacio's story of Isabetta of Messina is too well known to require repetition. De Gubernatis is of opinion that all the superstitions concerning this plant current in Southern Europe are of Byzantine origin. According to the *Apomasaris Apotelesmata,* to dream of Basil is unlucky.

In Europe Sweet Basil is used as a potherb for seasoning certain kinds of food, and is considered to have the same general qualities as thyme, sage, &c. It has long been a popular remedy for mild nervous or hysterical disorders, and in Buenos Ayres its fresh juice is said to be used as an anthelmintic, and to possess the advantage of not tending to produce unpleasant symptoms. Its essential oil was formerly in vogue as a carminative and nervine. (*Med. Record,* xvi., 325.)

Description.—Three forms of this plant are common in India: the mint-like garden basil, with large flowers and green or purple stems; the variety *pilosum* of Roxburgh having a

pleasant lemon odour; and a small variety common in gardens and on waste ground having a marked peppermint odour, and hardly different from *O. canum*. The ordinary garden basil has brown nutlets, but those of the pilose variety are black and correspond with the drug imported from Persia under the name of Tukm-i-riháu. They are small, black, oblong nutlets, barely $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, at the base there is a small projection with a white point. They have no odour, the taste is oily and slightly pungent. When moistened they become coated with a semi-ópaque mucilage.

Chemical composition.—The leaves distilled with water yield about 1·56 per cent. of a yellowish-green oil, lighter than water (*Raybaud, J., Pharm.* 20, 447), which, when kept, solidifies, almost wholly, as crystallised *basil-camphor;* the solid oil crystallised from alcohol forms 4-sided prisms, having a faint smell and taste; crystallised from water, it forms white, transparent, nearly tasteless tetrahedrons. It is neutral. Formula $C^{20}H^{16}6HO$. (*Bonastre, Dumas and Peligot in Gmelin's Handbook*, 14, 359.)

The price of the Persian seeds in Bombay is Rs. 4 per maund of 37½ lbs.

OCIMUM GRATISSIMUM, *Linn.*

Fig.—*Jacq. Ic. Pl. Rar. iii., t.* 495; *Rheede, Hort. Mal. x., t.* 86.

Hab.—Bengal, Chittagong, E. Nepal, Deccan Peninsula. The leaves.

Vernacular.—Ram-tulasi (*Hind. Mar. Beng.*), Elumichamtolashi (*Tam.*), Nimma-tulasi (*Tel.*), Káttu-tuttuva (*Mal.*), Káda-tulasi (*Can.*).

History, Uses, &c.—This plant is the Varvara, Barbara, and Ájvalla of the Nighantás. The leaves have a remarkably grateful lemon odour and taste, and are made into a *chutney*

by the Hindus, and are also used as a cooling remedy in gonorrhœa. Baths and fumigations prepared with this plant are used in the treatment of rheumatism and paralysis. A decoction of the mucilaginous seeds is used as a demulcent. This plant has been wrongly identified with the Palangmishk or Faranjmishk of Persia. The seeds imported into Bombay from Persia under these names bear no resemblance to those of *O. gratissimum.*

Description.—Stem erect, woody, perennial; bark ash-coloured; branches opposite, erect, 4-sided, when young smooth, glossy and green, whole height of the plant from 4 to 8 feet; leaves opposite, long-petioled, drooping, oblong, ventricose, remotely serrate, pointed, smooth on both sides, often 6 inches long, including the petiole, which is about a third of the whole; racemes terminal, pretty long, rigidly erect, with the verticels of six flowers pretty close; bracts short petioled, reflexed, cordate lanceolate; calyx, upper lip marked with three nerves; corol short, scarcely larger than the calyx, of a pale yellow underneath, oblong, concave, and entire; filaments longer than the corol, with a large tuft of dark yellow hairs on the joints of the large pair near the base. (*Roxb.*)

OCIMUM SANCTUM, *Linn.*

Fig.—*Burm. Thes. Zeyl.* 174, *t.* 80, *ff.* 1, 2; *Rumph. Herb Amb. v., t.* 92, *f.* 2. Holy Basil (*Eng.*).

Hab.—Throughout India. The leaves.

Vernacular.—Tulsi (*Hind., Guz.*), Tulasi (*Tam., Tel., Mal., Beng., Mar., Can.*).

History, Uses, &c.—The Tulasi plant is venerated in India by the Hindus like the Vervein was amongst the Romans. Its worship is expounded in the *Tulasikavaçam*, a little book composed of two parts: the first being the Tulasikavaçam

proper or "Tulasi amulet," from the *Tulasimáhátmya* of the *Brahmanda Purana,* and the second, a hymn in honour of the plant by a certain Pundarîka. The Tulasi is invoked for the protection of all parts of the body in life and death, and especially in its quality of *putradah putrakánkshinám,* or " giver of children." The plant is the beloved of the gods and of pious persons, to whom it affords its *amrita* (ambrosia); it is especially dear to Vishnu and Lakshmi, whence its synonyms Haripriya, Vishnupriya and Lakshmipriya. The divine Nárada has sung the praises of this immortal plant, which contains in itself every perfection, cures every ill, and purifies and guides to the heavenly paradise those who worship it. The mystery of the Tulasi is the mystery of the Creator.

The worship of the plant is strongly recommended to Vishnuites in the latter part of the *Padmapurana,* and it is also worshipped by the followers of Siva. Krishna, the popular incarnation of Vishnu, has adopted this herb for his cult, whence the name Krishna-tulasi. Sita, according to the *Ramayana,* was turned into a Basil plant, which on this account bears the synonym Sitahvaya. The connection between the Tulasi and the Amrita is indicated by the suspension over the plant of a dropping pot of water in the month *Vaisakh.* Worshippers of Vishnu wear a necklace of Tulasi beads, and the Vishnu *dûtas* or "messengers of Vishnu,"carry *tulasimani* rosaries. When a Hindu dies, his head is washed with water in which are placed Tulasi leaves and Sesamum seeds, and a sprig of the plant is placed upon his breast as a viaticum. According to the *Kriyáyogasaras,* the devout worshipper of the Tulasi is privileged to ascend to Vishnu's paradise accompanied by 10 millions of his kindred. The wretch who destroys the plant is abhorred of Vishnu, and can never hope for any prosperity; it may only be plucked for religious or medicinal use and when offering the following prayer:—" Mother Tulasi, who brings joy to the heart of Govindas, I gather thee for the worship of Narayana; without thee, O blessed one, every work is vain; that is why I pluck thee; O goddess, be propitious to me. As I gather thee with care, be merciful to me, O Tulasi, mother of the world, I beseech thee."

In worshipping the plant, it is addressed as the goddess Sri or Lakshmi—

> Sakhi, Subhe, Pápahárini, Punyade, Namaste,
> Náradanute, Náráyanamahâhpriye !
> O beloved, O beautiful, O destroyer of the wicked, O purifier;
> Honour to thee, O distinguished of Nárada, O dear to the heart of Vishnu!

The goddess is besought to protect the head (*çiras*), the forehead (*phâlam*), the sight (*driças*), the nose (*grâhnam*) in her quality of *sugandha* or perfumed, the face (*mukham*) in her quality of *sumukhi* or fair of face, the tongue, the neck, the shoulders, the body (*madhyam*) in its quality of *punyadâ*, &c., down to the feet. (*De Gubernatis.*)

The Tulasi plant may be often seen occupying a prominent position in front of Hindu houses; when thus kept it has to be watered and worshipped daily. It is often grown on the top of the Brundavanas* or square brick structures erected in the outer courts of temples, and in Calcutta, even in European compounds, there is hardly a hut occupied by a Darwán or Ooriya bearer without a pot of Tulsi close to the door. Frequently in the evenings a light is kept burning near the plant. Sanskrit writers make two varieties of this plant (founded upon some difference in the colour of their leaves), namely, white and black; the plant, irrespective of colour, is called in Sanskrit Tulasi and Parnasa. According to the *Raja Nirghanta*, it removes cold, destroys intestinal worms and evil spirits, and alleviates vomiting.

The leaves are said to be expectorant, and are prescribed in catarrhal affections. The dried leaves powdered are used as a snuff in a disease called *peenash* (ozœna). Ainslie mentions the use of the root in decoction in febrile affections. In the Concan a decoction of the leaves with the flowers of *Careya arborea* and black pepper is given in remittent fever. Tulasi is also an ingredient in prescriptions for rheumatism. (See *Vitex trifolia.*) The seeds are mucilaginous and demulcent.

* वृन्दावन (Vrindavana) is a raised platform of earth or masonry on which the worshippers of Krishna plant and preserve the Tulasi.

Description.—Stem short, woody, perennial; branches numerous, opposite, round, usually dark-purple, hairy; leaves opposite, petioled, oval, serrate, downy, about 1½ inch long and 1 inch broad; racemes terminal, erect, usually dark-purple, hairy, 4-sided; bracts opposite, petioled, cordate, reflex, 3-flowered; seeds black, oblong, about $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, blunt-pointed.

Other labiate plants, officinal in the East on account of their mucilaginous nutlets, are:—

Salvia plebeia, *Br.*, and **S. ægyptiaca,** *Linn.* var. *pumila* Bth. *Dcne. in Jacq. Voy. Bot.* 128, *t.* 133. The former plant is common in many parts of India, and the latter in the Salt Range and Trans-Indus, extending to Sind and Beluchistan.

The nutlets of *S. plebeia* are very small, $\frac{1}{30}$ of an inch long, ellipsoid, smooth, and of a brown colour; they are valued on account of their mucilaginous properties, and are administered internally in gonorrhœa. They are supposed to have strengthening properties, and are given to promote the sexual powers like many other mucilaginous drugs. The statement that they are used for killing vermin is a mistake. The plant is known as *Sathi* and *Samundar-sok* in the Punjab and Sind, and the seeds are sold in the bazars under the name of *Kammar-kas* or "strong-back." Theophrastus (H. P. ix., 19) mentions a κραταίογονος or "strong-back" which has not been identified. The Greeks were acquainted with *S. officinalis*, the *Elelisphakos* or *Sphakos* of Theophrastus (H. P. vi., 1, 2), and the *Elelisphakia* of modern Greece.

The nutlets of *S. ægyptiaca* var. *pumila* are much larger ($\frac{1}{12}$ of an inch), and are used in the north of India as a substitute for *Tukm-i-bálung*.

Chemical composition.—The seeds of *S. plebeia* have the following composition:—Water, 10·44; oil, 18·68; albuminoids, 11·90; gum and fibre, 43·98; ash, 15 per cent. No alkaloid is present. The nitrogen amounts to 1·88 per cent.

Lallemantia Royleana, *Benth.*, furnishes the nutlets sold in the bazars as *Tukm-i-bálung*. It is a plant of the Salt Range and Trans-Indus, extending to Persia, from whence the drug is imported *viâ* Bombay.

As met with in commerce, they are black, $\frac{1}{8}$ of an inch in length, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot; one side of the seed is broader than the other two, and slightly arched. The seeds when moistened become immediately coated with a tenacious, opaque, tasteless, grey mucilage.

Under the name of *Faranjmishk* or *Biranjmishk*, Arabic forms of the Persian name *Palangmishk*, the nutlets of an unidentified labiate plant are imported from Persia.

They are about $\frac{1}{12}$ of an inch in length, brown, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot. When moistened they become coated with a transparent mucilage. The taste is feebly pungent.

The plant from which they are said to be obtained is described by Persian medical writers as having a clove-like odour, on which account it is often called *Karanfal-i-bustani*, "garden clove." According to Abu Hanifeh, it is the same as the plant called by the Arabs *Asába-el-fatiyát* (*Calamintha Clinopodium*, Benth., the Wild Basil). It is considered to be cephalic, astringent, cardiacal, tonic, and carminative.

COLEUS AROMATICUS, *Benth.*

Fig.—*Wight Ill. ii., t.* 175; *Bot. Reg., t.* 1520. Country Borage (*Eng.*).

Hab.—Moluccas. Cultivated throughout India and Ceylon. The leaves.

Vernacular.—Páthar-chúr (*Hind., Beng.*), Pán-ova (*Mar.*).

History, Uses, &c.—This plant, found in every Indian garden, is the *Coleus aromaticus* of Loureiro, who describes it as resolvent, tonic and cephalic, and useful in asthma and chronic

cough; also in epileptic and convulsive affections. Roxburgh (*Fl. Ind.*, iii., 22) remarks that the leaves and all parts of the plant are delightfully fragrant, they are frequently eaten with bread and butter, also bruised and put into country beer, cool tankards, &c., being an excellent substitute for Borage. Amongst the natives of India the juice is a domestic remedy in colic and dyspepsia, and the crushed leaves are applied to relieve the pain and irritation caused by the sting of the centipede. The chopped leaves, made into pellets and dipped in a paste made of the flour of the chickpea, are fried in butter and eaten. Food prepared in this manner is a favorite Indian dish and is called भजें (*bhajen*). Dr. Wight speaks of the plant as a powerful aromatic carminative, given in cases of colic in children, in the treatment of which the expresssd juice is prescribed mixed with sugar or other suitable vehicle. In his own practice he observed it to produce so decidedly an intoxicating effect that the patient, a European lady, who had taken it on native advice for dyspepsia, had to discontinue it, though otherwise benefiting under its use. The Rev. J. Long (*Journ. Agri-Hort. Soc., Ind.*, 1858, x., p. 23) also notices its intoxicating properties. In the *Dict. Econ. Prod. of India*, ii., 504, it is stated on the authority of Dr. A. C. Mookerjee that the expressed juice of the leaves is considered an anodyne and astringent, and is applied round the orbit in cases of conjunctivitis. One of us has taken large doses of the fresh juice of the leaves without observing any intoxicating effect, and Mr. J. G. Prebble, who has experimented with a *succus* prepared from the fresh herb, informs us that in large and repeated doses it did not produce the slightest intoxicating effect. The *succus*, a sample of which he has kindly supplied, had the smell and taste of weak infusion of liquorice root.

Description.—The leaves of *C. aromaticus*, which are broad, ovate-crenated, and very thick, are about 3 inches long, and thickly studded with hairs, which on the upper-surface are principally jointed and tapering, but a few are simple and surmounted by a globular, transparent, brilliant gland like a minute dewdrop. On the under-surface the glandular hairs are most numerous, and give rise to a frosted appearance. The

epidermis is provided with numerous simple stomata. The venation is reticulate, and remarkably prominent on the under-surface of the leaf. A few oil globules are met with in the parenchyma, but the aroma is chiefly situated in the glandular hairs. The taste of the leaf is at first pleasantly aromatic, afterwards very pungent; the odour is agreeable and refreshing.

ANISOCHILUS CARNOSUS, *Wall.*

Fig.—*Wight Ill.*, *t.* 176 *b*, *f.* 1; *Linn. Amœn. Acad. x.*, 56, *t.* 3; *Rheede, Hort. Mal. x.*, *t.* 90.

Hab.—Western Himalaya, Central and Southern India. The leaves and essential oil.

Vernacular.—Pán-jira (*Hind.*), Kápúrli, Pán-jiren (*Mar.*), Karppúra-valli (*Tam.*), Roga-chettu, Omamu-aku (*Tel.*), Chomara, Kúrkha (*Mal.*), Dodda-patri (*Can.*).

History, Uses, &c.—Ainslie states that the fresh juice of the leaves mixed with sugar-candy is prescribed by the Tamil physicians in cynanche, who also prepare with it, in conjunction with the juices of other herbs and gingelly oil, a cooling liniment for the head. Dr. G. Bidie (*Madras Quart. Med. Journ.*, 1862, Vol. V., p. 269) describes it as a mild stimulant expectorant. Its properties depend upon a volatile oil.

In the *Dict. Econ. Prod. of India* it is stated on the authority of Surgeon-Major North that the juice of the leaves mixed with sugar and human milk is a popular domestic remedy for children's coughs in Mysore.

Description.—Stem erect, tetragonal; leaves petioled, ovate-rounded, obtuse crenated, cor date at the base, or rounded, thick, fleshy, hoary and tomentose, or villous on both sides; spikes long peduncled, at length cylindric; floral leaves ovate-obtuse; upper lip of calyx acute, glabrous, membranaceous, ciliated on the margin; lower lip truncate, quite entire; corolla bilabiate; upper lip bluntly 3 to 4-cleft, lower lip entire; flowers lilac.

LAVANDULA STŒCHAS, *Linn.*

Fig.—*Barrel. Ic., t.* 301. Arabian or French Lavender (*Eng.*), Stœchas Arabique (*Fr.*).

Hab.— Mediterranean Coasts to Asia Minor and Arabia. The flower spikes.

Vernacular.—Dháru (*Hind.*), Ustukhudus (*Ind. Bazars*).

History, Uses, &c.—Dioscorides states that this plant is called Stœchas from its growing on the Stœchades, a group of islands on the South Coast of Gaul near Massilia, now called Isles d'Hyères. It is the اسطادوس or اسطيقوس of Ibn Sina. It is much used by Mahometan physicians, who consider it to be cephalic, resolvent, deobstruent and carminative, and prescribe it in chest affections; they also think that it assists in expelling bilious and phlegmatic humors. (Cf. *Dios.* iii., 28; *Paul. Æg.* vi.; *Plin.* 26, 27.)

The author of the *Makhzan-el-Adwiya* devotes a whole folio page to a description of its properties, and especially enlarges upon its cephalic virtues; he concludes by saying, "In short Ustukhudus is the broom of the brain, it sweeps away all phlegmatic impurities, and removes obstructions, strengthening its powers, expelling vain crudities, and rarifying the intellect."

In Western India the drug is best known, though incorrectly, under the Portuguese name of Alfazema,* which is corrupted by the natives into Alphajan. In European medicine the flowers furnish the base of the *sirop de stœchas composé*, and are sometimes distilled for the sake of their essential oil, which is known as "false oil of Spike," the true oil of Spike being the produce of *L. Spica.*

L. Stœchas is known in Spain as "Romero Santo" (sacred rosemary). Its essential oil (also that of *L. dentata*) is there obtained for household use by suspending the fresh flowering

* *Lavandula vera, L. Stœchas,* is called Rosmarinho by the Portuguese in Europe.

stalks, flowers downward, in closed bottles and exposing them for some time in the sun's rays; a mixture of water and essential oil collects at the bottom, which is used as a hæmostatic and for cleansing wounds. (*J. C. Sawer.*)

Description.—The purple flowers occur in short-stalked spikes and are situated in the axils of downy, heart-shaped bracts. The upper bracts, which are abortive, form a purple tuft at the top of the spike. The drug has a camphoraceous odour and a hot bitter taste. The odour of the oil, which is of a reddish-yellow colour, recalls that of oil of rosemary.

Chemical composition.—The specific gravity of Spanish oil of *L. Stœchas* is 0·942 at 15° C. It boils between 180° and 245°. (*J. C. Sawer, Chem. and Druggist*, 1891, No. 567.)

Commerce.—The drug is largely imported from Europe. Value, Rs. 8 per maund of 37½ lbs.

JADEH.

The جعده of the Arabian physicians is generally considered to be the Fuliyun (πόλιον) of the Greeks; by some supposed to be the Poley-Germander (*Teucrium Polium*, Linn.); it is described as deobstruent, diuretic, anthelmintic, and tonic. (*Diosc.* iii., 115; *Plin.*, 21, 60, 84.) Dumolin, however, maintains the πόλιον of the Greeks and the Polium of Pliny to be *Santolina chamæcyparissus*, the "Lavender Cotton" of our gardens. Ibn Sina describes Jadeh as نوع من الشيح, "a kind of wormseed." Persian writers on *Materia Medica* give *Gul-i-urba* and *Amberbed* as its synonyms.

Dr. Jayakar, Civil Surgeon at Muscat, and a distinguished Arabic scholar, forwarded to one of us in 1885 a plant growing on the hills near that town which is called Jadeh, and also a specimen of the Jadeh of the Muscat shops which comes from Bandar Abbas. Both of Dr. Jayakar's specimens are woody, labiate plants, with linear leaves and terminal crowded spikes of flowers, both are densely covered with a cotton-like down, more especially the Persian specimen. The two plants are evidently

very closely related; they are used in febrile affections by the Arabs, one ounce being steeped in cold water all night, and the infusion strained and taken in the morning. In infantile fevers the body is fumigated with the drug.

The specimens were forwarded to Kew, but have not, as far as we know, been identified. The Bander Abbas Jadeh, as sold in the shops, consists of the flowers mixed with a few leaves and stems. The flowers are about $\frac{3}{16}$ of an inch long, and only protrude a little from the cottony calyx; they are permanent and firmly attached to the seeds, which are black, rugose, and somewhat kidney-shaped. The odour of the drug somewhat resembles that of wormseed, while that of the Arabian plant is more like lavender.

POGOSTEMON PARVIFLORUS, *Benth.*

Syn.—*P. purpuricaulis*, Dalz. in *Hook. Kew Journ. ii.*, 336.

Hab.—Sub-tropical Himalaya, Deccan Peninsula. The root and leaves.

Vernacular.—Pangala, Phangala (*Mar.*).

History, Uses, &c.—This plant hardly differs from *P. purpurascens*, and is very closely related to *P. plectranthoides*, *P. glaber*, and the variety *suavis* of *P. Patchouli*. It does not appear to be mentioned by Sanskrit medical writers, but the root has a popular reputation as a styptic. In the Ratnagiri District of Western India, the root has long been in use amongst the natives as a secret remedy for the bite of the Phúrsa snake, and in February 1871, Mr. H. B. Boswell, the Collector, addressed the Civil Surgeon in the following terms:—"I have the honor to send you a specimen of a root which I have reason to believe to be a cure for the bite of the Phúrsa snake, and I shall feel very much obliged to you if you can in any way ascertain its medicinal properties and its effect on any one so bitten.

"It is said to stop all the after ill-effects of this poisonous bite, which is more than Liquor Ammoniæ will, I believe,

often do. The patient is to eat as much of it, after it has been washed, as would make in bulk the size of the first joint of one's first finger. This he is to do three times a day for seven days. It is also to be applied externally to the wound. I cannot, of course, vouch for the truth of this, or the efficacy of the cure, but one of my sepoys, who was bitten by a Phúrsa a week ago, has been doctored by the *Patel* (village headman) of this place, in this manner, and is now apparently well. The *Patel* after much persuasion has shown me the root and the plant, one I know well, but the name of which I am not at liberty at present to mention. He also assures me that this is all he uses."

The plant was forwarded in April 1871 to the Chemical Analyser to Government, who identified it as a species of *Perilla*, and expressed an opinion that it was highly improbable that a plant belonging to the Labiatæ would prove to be a specific for snake-poisoning, and suggested that some trustworthy evidence of its value should be obtained before he undertook an analysis. In June of the same year, Dr. C. Joynt, the Civil Surgeon, reported the following case:—"A sepoy, aged 27, was admitted on the night of the 29th; Liquor Ammoniæ was applied to the wound after incising; next morning there was hæmorrhage from the wound, and also free hæmorrhage from the gums and tongue, the blood escaping had a bright arterial hue. A scruple of the root was ordered three times a day. The first dose decidedly relieved the vertigo which he complained of, and next day there was a marked diminution in the hæmorrhage from gums and tongue, which entirely ceased on the fourth day. No other medicine was given." Dr. Joynt remarked:—"The employment of the root in this case appears to have been singularly beneficial, and to deserve further investigation."

Unfortunately, Dr. Joynt left Ratnagiri shortly afterwards and was unable to continue his investigations. In the Annual Report of the Ratnagiri Police Hospital for the year 1873-74, the following remarks by Dr. E. H. R. Langley, the Civil Surgeon, occur:—"Snake-bites furnished two cases; these injuries were caused by snakes called 'Phúrsa' by the natives (*Echis carinata* of ophiologists). A rapid cure was effected by

the internal administration, together with local application of the root of a shrub, '*the Pogostemon purpuricaulis,*' very common all over the Concan." In 1874 Dr. Langley made the following report to the Deputy Surgeon-General:—"Thirteen cases arising from the bites of poisonous snakes were treated in the Civil Hospital, Ratnagiri. The only remedy used was the pounded root of a plant called *Pangla,* the '*Pogostemon purpuricaulis* of botanists'; the root of this plant is given internally as well as applied as a paste locally; all these cases did well, and were discharged from two to four days after admission."

In 1884 Dr. H. McCalman, Civil Surgeon, Ratnagiri, forwarded a communication, "*On the treatment of Phoorsa bite by Pangla root with illustrative case,*" to the Bombay Medical and Physical Society, from which we extract the following remarks:—"The *Echis carinata,* a viperine snake, is very common in the Ratnagiri District. Fayrer describes it as fierce, active and aggressive, always on the defensive, and ready to attack. The bite is eventually highly dangerous, although the symptoms may be slow in developing. In fatal cases death usually occurs in from 4 to 6 days, and is preceded by giddiness, great lethargy and depression, hæmorrhagic discharges, albuminuria, and occasionally lockjaw." * * *
"Pangla root, chewed in a fresh state, has been used for some years by Drs. Joynt, Langley, Barker and myself in the treatment of Phoorsa bite, and with invariable success."

The following is Dr. McCalman's illustrative case:—Rowjee Balsawant, Hindoo, police constable, aged 45, was admitted to hospital on the 14th June 1884, at 6 A.M. An hour previously he was bitten on the dorsum of the foot by a Phoorsa snake, afterwards recognized and killed. He was immediately given Pangla to chew, and a poultice of the leaves applied locally. At 9 A.M. there was much pain in the part, œdematous swelling of the foot and ankle, extending half-way up the leg, giddiness, a feeling of great depression, and hæmorrhage (dark-coloured) from the gums, under surface of the tongue and buccal mucous membrane generally. The blood expectorated did not coagulate. This bleeding had begun at

6 A.M., an hour after the man had been bitten. Pulse 72, temperature 98° F., no dyspnœa. Finding the hæmorrhage unchecked by the remedy, some perfectly fresh root just dug up was substituted for that first given. The effect was soon apparent.

At 2 P.M., giddiness less, pulse 78, temperature 99°, expression tranquil, urine dark-coloured, depositing a slight flocculent sediment, reaction acid, sp. gr. 1012, albumen to a considerable extent. Pain of the foot less.

6 P.M., bleeding from the mouth practically stopped, giddiness increased, pulse 72, temperature 99°·4. Urine shows blood corpuscules under the microscope.

15th.—No hæmorrhage from the mouth; urine contains a considerable quantity of blood; vertigo less. Swelling of limb less. Pulse as yesterday and of fair volume.

16th.—No hæmorrhage whatever. No giddiness. Urine pale, no sediment, no albumen, sp. gr. 1008. Pulse 66. Stiffness of foot, but no real pain.

17th.—Swelling rapidly disappearing. No head symptoms. Urine very pale and plentiful, sp. gr. 1004.

18th.—Pangla omitted. His convalescence was uninterrupted, and he left the hospital on the 22nd perfectly well.

Dr. McCalman remarks:—"I do not pretend to explain the action of Pangla; that the remedy acts generally and physiologically is apparent from the early drying up of remote hæmorrhages (*e.g.*, bleeding from the urinary tract) and the relief of cerebral symptoms, effects due to a restoration of the natural state of the blood, and, through it, of the nervous centres. The drug may also stimulate organs concerned in the elimination of the poison. The subject is one which calls for further careful experimental research."

Through the courtesy of Surgeon-General Pinkerton we have been supplied with further extracts from the records of the Ratnagiri Civil Hospital, which show that Pangla root is still used with the same success in the treatment of Phúrsa bite.

Only one fatal case is recorded, and in that the remedy was administered in the form of tincture instead of in the usual manner.

Mr. G. W. Vidal, C.S., in a letter to the *Bombay Gazette*, dated January 30th, 1890, states that the bite of the Phúrsa snake is apparently fatal in about 20 per cent. of cases, and the action of the poison is slow. He says: "In collecting materials for an account of the snakes of Ratnagiri for the *Bombay Gazetteer*, I found (in 1878) records of 62 fatal cases treated at the Civil Hospital. These cases showed that death occurred on an average in four and a half days, though in some instances patients had lingered up to twenty days." In 1855-56 Dr. Imlach, then Civil Surgeon of Shikarpur, in a description of the 'Kapar' (*Echis carinata*), published in the *Transactions of the Bombay Medical and Physical Society* (Vol. iii., New Series, p. 80), wrote that "a reference to police returns will show that in by far the majority of cases serious injury and death have been caused by the bite of this species." In an article upon the "Venomous Snakes of North Canara" (*Journ. Nat. Hist. Soc. Bombay*, Vol. v., No. 1, p. 69), Mr. Vidal says:—"There is indeed no doubt that the *Echis* is a far more potent factor than any other venomous snake in swelling the mortality of the Bombay Presidency, and it is important that this fact should be more generally known and recognised than it has been hitherto. It is, of course, impossible to show the exact percentage of the deaths from snake-bite for which the *Echis* is responsible. In the returns no attempt is made to discriminate the species to which the recorded deaths are attributable, and little if any reliance could be placed in the statistics, even if such an attempt were made. But the conclusion stated above may, I think, be fairly drawn from the fact, which is very clear from the returns in their present shape, that in all those districts, where the *Echis* is known to abound, the average mortality from the snake-bite is *markedly* high, while conversely, the mortality is insignificant in other districts where the *Echis* is either rare or absent. The following table, which I have compiled with some care and labour from the official returns for the eight years, 1878—85, shows the

population, the actual average mortality, and the mortality per *mille* of each district in the Bombay Presidency :—

District.	Population by Census of 1881.	Average actual mortality from snake-bite, 1878 to 1885.	Average mortality per *mille*, 1878 to 1885.
Hydrabad	754,624	181 7	0·247
Thar and Parkar	203,344	48·7	0·239
Karachi	478,688	87·2	0·182
Ratnagiri	997,090	154·5	0·155
Thana	908,548	108·8	0·119
Panch Mahals	255,479	30·5	0·119
Shikarpur	852,986	72·8	0·085
Surat	614,198	41·5	0·067
Kaira	804,800	47·2	0·0586
Broach	326,930	19·1	0·0584
Upper Sind Frontier	124,181	6·7	0·053
Kolaba	381,649	19·8	0·052
Ahmedabad	856,324	39·6	0·046
Sattara	1,062,350	41·0	0·038
Kanara	421,840	16·0	0·037
Belgaum	864,014	30·2	0·034
Poona	900,621	18·6	0·020
Dharwar	882,907	17·6	0·019
Khandeish	1,237,231	23·1	0·018
Bijapur	638,493	11·0	0·017
Nasik	781,206	10·8	0·0138
Ahmednagar	751,228	10·3	0·0137
Sholapur	582,487	2·2	0 003

Thus three Sind districts and Ratnagiri, in all of which the *Echis* swarms in suitable localities, stand well at the top of the list with an average mortality, taking the four districts together of ·205 per 1,000. On the other hand, in the last four districts on the list, *viz.*, Bijapur, Nasik, Ahmednagar and Sholapur, the combined average mortality per *mille* is only ·0118. In other words only one man dies of snake-bite in about 100,000 in these Deccan districts, while in the *Echis*-ridden tracts one man dies in every 5,000. Daboias and kraits are probably nowhere so common in Western India as to have much appreciable effect on the mortality. But cobras are quite as common, I believe, in these Deccan districts as they are in Ratnagiri or

Sind. This shows, I think, pretty conclusively that the *Echis* —and not the cobra, or any other venomous snake—is chiefly responsible for deaths from snake-bite in Bombay."

The fresh leaves of *P. parviflorus* have a pungent taste, and when bruised are in general use in the Concan as a cataplasm to clean wounds and sores, and to stimulate healthy granulation.

Description.—A stout, erect, branched shrubby plant; glabrous, pubescent, or scaberulous. Leaves long-petioled, ovate or ovate-lanceolate, singly or doubly crenate-toothed or serrate, base cuneate, whorls subglobose, in dense cylindric or one-sided softly hairy spikes, bracts elliptic-ovate, exceeding the hirsute calyx, calyx-teeth short, triangular-lanceolate, ciliate. Nutlets very small, black, shining. The whole plant has a strong black currant odour. Roots woody, knotted; bark light brown, scabrous, with an aromatic odour like that of the plant, and a pungent taste, benumbing the tongue and palate when chewed.

Chemical composition.—The most interesting principle detected in the plant was an alkaloid. After repeated purification it was left as a yellow varnish with slightly bitter and mouse-like flavour. It was more soluble in chloroform than in ether. No special colour reactions were noted. We also detected the presence of trimethylamine, and a volatile principle with a cedar-wood odour. Resinous principles were also present, with astringent matter. We provisionally call the alkaloid *Pogostemonine.*

MENTHA SYLVESTRIS, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 82; *Eng. Bot.* 686. Wild Mint (*Eng.*), Menthe sauvage (*Fr.*).

Hab.—Temperate W. Himalaya, Persia. The herb.

Vernacular.—Pudína or Púdina (*Hind., Tam., Beng., Guz.*), Chetni-maragu (*Can.*), Vatalau, Pudína (*Mar.*).

History, Uses, &c.—A fragrant plant named μίνθα or μίνθη, in Latin Mintha or Mentha, was known to the Greeks and Romans (*Theophr.*, ii., 4; *Plin.*, 19, 47; 20, 53), which was

probably a kind of mint. According to Pliny, the name of this plant was afterwards changed to ἡδύοσμον on account of the sweetness of its smell. It was used as an ingredient in sauces and for medicinal purposes; it is impossible to determine with certainty which species of mint was used by the ancients, but it is generally supposed to have been *M. sativa,* Linn.

Ovid tells us that Myntha was a nymph beloved of Pluto, who was turned into a plant by Proserpine out of jealousy. De Gubernatis (*Myth. des Plant.*, ii., 226) says:—"Les Français l'appellent *Menthe de Nostre Dame,* les Allemands *Unser Frauen Müntz,* Pietro de Crescenzi, *Herba sanctæ Mariæ.* Dans la *Naturale et generale Historia dell' Indie Occidentali* (Ramusio) on lit: "*L'herba buona,* che in alcune parti chiamano *herba santa,* e in molto altre *menta.*" Dans les *Allégories d'Azz Eddin,* traduit par Garcin de Tassy, la menthe semble jouer, au contraire, un assez vilain rôle. Le basilic en parle ainsi au jasmin: "Tu auras peut-être entendu dire qu'il existe un délateur (la menthe) parmi les êtres de mon espèce; mais, je t'en prie, ne lui fais pas de reproches; il ne répand que sa propre odeur; il ne divulgue qu'un secret qui le regarde; il ne dévoile enfin que ce qu'il peut découvrir." Quelle allusion peut contenir cette allégorie? Est-il possible que la vieille équivoque latine entre les mots *mentha* et *mentula* se soit répétée dans une langue orientale? * Quant à la première, elle est certaine, et les poètes pornographiques italiens en ont bien abusé. Il faut sans doute encore songer à cette équivoque, pour comprendre l'origine de la superstition Sicilienne de Caltavuturo, dans la province de Palerme; on y croit que si la femme dans ses mois s'approche de la menthe, la plante périra; autrefois, au lieu de *menta,* on entendait probablement *mentula:* d'où la croyance qui, autrement, serait inintelligible.

Apulée, *De Virtutibus Herbarum,* indique le rite qu'il faut suivre pour cueillir la menthe: "Lege eam mense Augusto, mane primo priusquam sol exeat, mundus, ad omnia sic dicens: Te precor, herba *hedyosmos,* per eum qui nasci te jussit, venias ad me

* Immovero sic est, نعنع idem valet.

hilaris cum tuis virtutibus et effectu tuo, et ea mihi præstes quæ fide a te posco."

Mint does not appear to be mentioned by Sanskrit medical writers. In Arabic نعنع (*naanaa*) and حبق (*habak*) are general names for the mints, but they are best known as Fudanaj, the Arabic form of the Persian word Púdina or Púdang. The author of the *Makhzan* describes three kinds of Fúdanaj, wild, mountain, and water mint; the latter, he says, is the Calamintha of the Greeks. Mountain mint is described as having hoary leaves, but it is impossible from his description to form any opinion as to the exact species to which he refers. The mints are considered to be hot and dry, and are prescribed in dyspeptic affections, fluxes, and dropsy. Different kinds of mint are much cultivated in Indian gardens, and are used as domestic remedies on account of their stimulant and carminative properties. They are often made into a medicinal *chutney*, which is eaten to remove a bad taste in the mouth in febrile conditions of the body, *e.g.*, Púdína, khárik (dry dates), black pepper, rock salt, raisins, and cumin in equal proportions are rubbed into a chutney with limejuice.

In colic, mint juice with a little black pepper and honey is given.

Description.—*M. sylvestris* has leaves broadly or narrowly oblong, obovate or lanceolate subacute, serrate, hoary beneath, whorls in terminal spikes, calyx-teeth triangular or lanceolate, corolla hairy, glabrous within. Nutlets usually pale, smooth, sometimes brown and delicately reticulate. (*Fl. Br. Ind.*)

The plant varies much in size and habit. Aitchison observed it in Biluchistan in beds of streams amongst tamarisk shrubs, growing nearly seven feet high and forming large clumps. Another variety was collected by him on the Harirud valley.

Mentha viridis (spear-mint), *M. piperita* and *M. incana* (peppermint), *M. sativa*, and *M. aquatica*, occur in Indian gardens, and as escapes. *M. arvensis* is a native of the Western Himalaya.

Chemical composition.—The most important constituent is the volatile oil, which has the same composition as oil of peppermint, but differs from it in odour and flavour (see p. 107).

The plant contains a little tannin.

Commerce.—The dried plant of *M. sylvestris* is a regular article of import from Persia into Bombay. Value about 2 annas per lb.

MENTHA ARVENSIS, *Linn*, var. *piperascens.*

Hab.—China and Japan. The essential oil, and Menthol or Peppermint camphor.

Vernacular.—The oil.—Lin-tsao (*Chin.*), Hakano Abura (*Japan*), Púdine-ka-têl *or* atar (*Hind.*, *Beng.*), Vatalau-cha-têl (*Mar.*), Phudino-nu-têl (*Guz.*), Pudina attar *or* tailam (*Tam.*), Pudina-attaru *or* tailamu (*Tel.*), Pudina-attar *or* yanne (*Can.*). Menthol.—Po-ho-yo (*Chin.*), Hatsca (*Japan*), Pudine-ke- phúl (*Ind. Bazars*).

History, Uses, &c.—Peppermint was in use in China and Japan at least 2,000 years ago. The Fudanaj-el-tays, "Mentha hircina," of Ibn Sina appears to have been peppermint; he describes it as a very efficacious kind of mint and a good diuretic. Haji Zein el-attar (1368) mentions a kind of mint called Filfilmún, *i.e.*, "having the qualities of pepper," also known as Púdineh-i-kohi or "hill mint." Both the Arabs and Persians appear to have been well acquainted with the value of this mint in neuralgic affections. It is interesting to observe that in Hull's *British Flora*, Manchester, 1799, pepper-mint is named *Mentha hircina*. Peppermint is not mentioned by Sanskrit writers on *Materia Medica*. From the *Pharmacographia* we learn that *peper-mint* was first observed by Dr. Eales and communicated to Ray, who noticed it in his *Synopsis* in 1696. Dale, in 1705, states in his *Pharmacologiæ Supplementum* that it is esteemed a specific in renal and vesical calculus; and Ray, in the third edition of his *Synopsis*, declares it superior to all other mints as a remedy for weakness of the stomach and for diarrhœa.

Upon the Continent of Europe peppermint became practically known about the latter end of the last century (*op. cit.*, *2nd ed.*, p. 481). Peppermint camphor was first described by Gmelin in 1829, who obtained it from the European plant. Pereira and Guibourt notice the menthol of China, and in 1862 a memoir on crystallized oil of peppermint from Japan was presented to the Chemical Society by Oppenheim, who speaks of it as coming to Europe in earthenware jars, and often adulterated with sulphate of magnesium to the extent of 10 to 20 per cent This, however, was not the case with a sample examined by Moss and also by G. H. Beckett and C. R. Alder Wright in 1874. When first brought to Europe it was used as a remedy for headache and neuralgia, and was known in France as *Gouttes Japonaises.* In 1879 Mr. Archibald Duncan, a student of the University of Edinburgh, drew attention in the *Lancet* to its value as an antiseptic. Dr. A. Rosenberg (*Lancet*, 1885) recommended an alcoholic or ethereal solution as a local anæsthetic in affections of the nose, pharynx, and larynx. The use of menthol for these purposes has now become general in Europe and America. Dr. Lahnstein (*Therap. Monatsh.*, 1890, No. 5) has used menthol with striking success against vomiting in a child with traumatic peritonitis where opium and morphine had failed.

Dr. Drews (*Therap. Monatsh.*, 1890, No. 7) has conditionally confirmed the communications of Gottschalk and Weiss concerning its value in obstinate vomiting of pregnancy.

Dr. Bronner of Bradford reported at the 62nd meeting of German Scientists and Physicians in Heidelburg on the success obtained by him with menthol (a few drops of a 20 per cent. solution in olive oil poured on pieces of pumice stone) in obstinate swelling of the tubes as well as in some cases of sclerosis. (*Therap. Monatsh.*, 1890, No. 8.)

Dr. Jones (*Deutsch. Apoth-Zeit.*, 1890, p. 143) has used menthol successfully in 20 per cent. alcoholic solution for inhalation in asthmatic cases. Lastly, the success obtained with menthol against diphtheria must be mentioned.

Dr. Hermann Wolff (*Therap. Monatsh.*, 1890, No. 9) has exhaustively reported on his experience of two years with the treatment. In India it is chiefly used as a stimulant carminative by vegetarians in the same manner as the essential oil of peppermint, which is largely imported from China and Japan. One of us has found a large rectal injection of essence of peppermint in warm water afford marked relief in renal colic.

Description.—Chinese oil of peppermint is generally high coloured and very pungent, with a bitter after-taste. It is now often deprived of its menthol, but still appears to be unable to compete with the Japanese oil which has nearly driven it from the Indian market. The menthol of China and Japan occurs in long hexagonal crystals, resembling sulphate of magnesium, which contain much water. E. B. Kyle (*Amer. Journ. of Pharm.*, 1885) mentions the following among the properties of menthol. When thrown upon water, currents are produced to and from the dissolving crystals. Menthol liquifies with chloral, thymol, and camphor; and this action is particularly noticeable with thymol, crystals of the two substances placed in contact being in a few minutes transformed into a thick oily liquid. On gently heating a mixture of 1 drachm of the aqueous solution of menthol with half a drachm of a solution of 1 grain of iodine and 5 grains of potassium iodide in two drachms of water, with a small quantity of potash solution, the characteristic odour of iodoform is developed. The aqueous solution is not affected by ferric chloride or bromine water, but yields a slight turbidity with chlorine water. One grain of menthol yields, with 120 drops of sulphuric acid, a brownish red liquid of a very disagreeable odour, and on the addition of a little potassium bichromate becomes chrome-green, the colour remaining unaltered for several weeks. Menthol slightly warmed with nitric acid yields a thick, wine-coloured, oily liquid, and at a higher heat red fumes are given off; on neutralizing now with ammonia, a precipitate is observed which is soluble in alcohol, and the solution when evaporated yields an indistinctly crystalline mass.

The oil of *M. arvensis*, var. *piperascens*, distilled from the fresh plant, grown at Mitcham, by Moss had a decided yellow colour, and a sp. gr. of ·9107 at 62° F. With the barometer at 30 in. it boiled at 402° F.

The sp. gr. of the oil after determining the boiling point, was found to be ·9117 at 62° F.

Other specimens of oil distilled in England from the dry imported herb, were found by Moss to be different in appearance and physical properties from that distilled by him. One labelled "non-rect." was distinctly green, and had a sp. gr. of ·9167 at 62°F.; a second, labelled "rect.," was pale in colour, with a faint green tinge, and had a sp. gr. of 9098. The sp. gr. of these oils confirm Todd's generalization that pure oils fall between ·908 and ·917. (*Pharm. Journ.*, p. 446, 1886.) None of the three oils gave any coloration when subjected to the test given in Todd's paper above mentioned. It consists in adding one drop of oil to a mixture of 25 drops of alcohol with one drop of nitric acid, sp. gr. 1·2. With the oil of *M. piperita* a permanent blue or bluish-green colour is developed.

Chemical composition.—Oil of peppermint owes its peculiar odour to *menthol* (mint camphor, mint stearopten), $C^{10}H^{20}O$, which is chiefly contained in the last portions obtained on subjecting the oil to fractional distillation. It forms colourless prisms which fuse at 42° C. and boil at 212° C. Distilled with phosphoric anhydride, it yields *menthene* $C^{10}H^{18}$, which is a colourless liquid of an agreeable odour. According to Moriga (1881), oil of peppermint contains probably also an oil of the formula $C^{10}H^{18}O$, which may be prepared from menthol by oxidation with potassium bichromate; but by treatment with fuming nitric acid menthol yields at first an explosive oil, afterward crystals of an acid $(C^5H^8O^4)^2H^2O$, melting at 97°C.; this compound is not identical with pyrotartaric acid, with which it agrees in composition. A compound isomeric with borneol had been found by Beckett and Wright (1875) in the liquid portion of Japanese peppermint oil, but, according to Flückiger and Power (1880), is not present in

the oil distilled at Mitcham, which contains, besides menthol, several hydrocarbons of the formulas $C^{10}H^{16}$ and $C^{15}H^{24}$, and having a terebinthinate somewhat lemon-like odour. (*Stillé and Maisch.*)

Commerce.—Chinese oil of peppermint and menthol are imported into India in quarter-catty flat bottles, bearing a Chinese label. Four or more of these bottles are packed in a tin box. The Japanese oil is packed in tins of various sizes and has generally an English label, much of it is of very inferior quality, the menthol having been separated. Cocking's is the best brand, and is packed in glass bottles with paper cases. Value—oil, Rs. 4 to 5 per lb.; menthol, Rs. 8 per lb.

Indian substitutes for peppermint are **Mentha incana,** *Willd.*, much cultivated in gardens, and wild in Northern India, and **Micromeria capitellata,** *Benth.*, a native of Behar, the Western Himalaya and the Western Ghâts, described by Dalzell as rivalling the peppermint in its aromatic and carminative properties.

ORIGANUM MARJORANA, *Linn.*

Fig.—*Woodv. Med. Bot. t.* 165. Sweet Marjoram (*Eng.*), Marjolaine (*Fr.*).

Hab.—Portugal to Western Asia. Cultivated in India. The herb.

Vernacular.—Marwa (*Indian Bazars*).

History, Uses, &c.—The name ὀρίγανον, in modern Greek ῥιγανι, was applied in ancient times to plants of this genus, but *O. marjorana* was distinguished by the names σαμψυχον and αμαρακος. A Greek myth informs us that Amaracus was a page to the king of Cyprus, who one day on letting fall a vessel of perfume became so frightened that he was turned into this plant. The Greeks and Romans decorated the newly married with it. Catullus says:—

> Cinge tempora floribus
> Suaveolentis Amaraci.

It is the Marjolaine of the French. De Gubernatis states that in Southern Europe it is the symbol of honour and the protector of married women. It is the Maruva and Jambhira of the Raja Nirghanta and the Marwa or Marzangush of the Persians. Ibn Sina calls it Marzanjush. The Persian word signifies "mouse-ear," a name given to it on account of the greyish downy character of the leaves, which is more marked in the Persian variety than in the European plant. Marjoram is cultivated as a pot-plant in most Indian gardens, and is used as a substitute for thyme in cookery. At Bandora, near Bombay, it is grown as a garden crop to supply *bouquets* for the Bombay market, which are much worn by women in their hair. The medicinal uses of Marjoram in the East are similar to those of mint.

Description.—An annual herb. The leaves are spatulate or oval, very obtuse, entire, gray green, soft-hairy, and pellucid punctate. The flowers are aggregated in small heads and have a small whitish corolla. The plant is agreeably and pungently aromatic.

Chemical composition.—The volatile oil (*Oleum majoranæ*) is thin, yellowish, of the specific gravity 0·89, boils above 163° C., is readily soluble in alcohol, has the aromatic odour of the herb, and, according to Beilstein and E. Wiegand (1882), contains a terpene boiling at 178° C. and forming a liquid compound with HCl; the fraction boiling between 200° and 220° C. has the composition $C^{15}H^{26}O$, and is not affected by metallic sodium. (*Stillé and Maisch.*)

THYMUS SERPYLLUM, *Linn.*

Fig.—*Engl. Bot., xxii., t.* 1514. Wild Thyme (*Eng.*), Serpolet (*Fr.*).

Hab.—Western Temperate Himalaya, Persia, Europe. The herb.

Vernacular.—Másho (*Panj.*), Háshá (*Pers. Ind. Bazars*).

History, Uses, &c.—Háshá is the Persian name of *T. serpyllum*, but it has been adopted by the Arabian and Persian

physicians as the equivalent of the θύμος of Dioscorides, a plant concerning the identity of which there is much doubt: some supposing it to be the *Satureia capitata* of Linneus, and others the *Thymus vulgaris* or *T. Zygis* of the same botanist. Ibn Sina in his description of Háshá quotes what Dioscorides says concerning θύμος, and does not notice the ἑρπύλλος of the same author usually identified with *T. serpyllum*. Haji Zein el-Attar follows Ibn Sina in identifying Háshá with the θύμος of the Greeks; and describes it as a kind of mountain mint with very numerous small flowers of a purplish colour, slender stems, and leaves like the *Jadeh*. His description of its medicinal properties hardly differs from that of Pliny (21, 89), which is as follows:—"Thyme is considered to be very beneficial to the sight, whether used as an article of food or as a medicament, and to be good for inveterate coughs. Used as an electuary with vinegar and salt, it facilitates expectoration, and taken with honey prevents the blood from coagulating. Applied externally with mustard, it dispels chronic fluxes of the fauces, as well as various affections of the stomach and bowels; still, however, it must be used in moderation, as it is of a heating nature, and acts as an astringent on the bowels. In cases of ulceration of the intestines, the dose should be one denarius of thyme to one sextarius of oxymel; the same proportions, too, should be taken for pains in the sides, between the shoulder-blades, or in the thoracic organs. Taken with oxymel, it is used for the cure of intestinal diseases, and is administered in cases of alienation of the senses and melancholy. Thyme is given also for epilepsy, when the fits come on, the smell of it reviving the patient; it is said, too, that epileptic persons should sleep upon soft thyme. It is good also for hardness of breathing, and for asthma and obstructions of the catamenia. A decoction of thyme water, boiled down to one-third, brings away the dead fœtus, and it is given to males with oxymel, as a remedy for flatulency, and in cases of swelling of the abdomen or testes and of pains in the bladder. Applied with wine, it removes tumours and fluxes, and in combination with vinegar, callosities and warts. Mixed with wine, it is used as an external application

for sciatica; and beaten up with oil and sprinkled upon wool, it is employed for diseases of the joints and for sprains. It is applied also to burns, mixed with lard. For maladies of the joints of recent date, thyme is administered in drink, in doses of three oboli to three cyathi of oxymel. For loss of appetite it is given beaten up with salt."

The ancients appear to have been acquainted with the antiseptic properties of thyme. Virgil (Georg. IV., 241) speaks of the fumigation of beehives with the smoke of the burning plant, and the name θύμος is derived from θύω, to burn incense. Macer Floridus (*De Vir. Herb*) recommends thyme as a remedy for the bites of venomous animals. In the Punjab the seeds of *T. serpyllum* are given as a vermifuge. (*Stewart.*) The plant is an indifferent substitute for *T. vulgaris*, as it contains hardly any thymol. The latter principle is, however, afforded abundantly by the seeds of *Carum copticum*, a plant largely cultivated in India. Thymol is a powerful antiseptic; when absorbed it paralyses the nerve centres in the cord and medulla, and like carbolic acid lessens reflex action, slowing the respiration, and lowering the blood-pressure and temperature. In poisonous doses it causes weakness, drowsiness, coma and death. It differs from carbolic acid in being less volatile and less easily oxidised. Its action as a disinfectant is more permanent and at the same time more powerful than that of carbolic acid. It is less irritating to the skin or mucous membrane, and does not act as a caustic like carbolic acid, and is a less powerful poison to mammals. Its action on the nerve-centres is a paralysing one from the first, and is not preceded by excitement as in the case of carbolic acid. While in the body it appears to effect tissue-metabolism, for in animals poisoned by it the liver is found quite fatty, as in phosphorus-poisoning. It appears to be eliminated by the respiratory and urinary organs and to cause irritation of these organs during the process of excretion. In poisoning by it, the bronchial mucous membrane is extremely congested, the secretion of mucous increased, the lungs congested, and sometimes consolidated; the kidneys

inflamed, and the urine albuminous or bloody. Thymol has been used as an antiseptic, as an application to skin diseases, ringworm, eczema, psoriasis; as a gargle, spray, or inhalation in sore-throat, bronchiectasis and phthisis, or as an injection in ozæna. Internally it has been used in diabetes and vesical catarrh. (*Lauder Brunton.*)

Dr. Gross (*Pharm. Zeitsch.*, 1890, p. 261) reports on the successful results obtained with thymol in the treatment of diphtheria, having found it the most effective remedy in 280 cases. He prescribed, according to the age of the child, a 0·1 to 0·3 per cent. solution in doses of 10 to 12 drops every 5 to 10 minutes, according to the severity of the case. The solution was flavoured with some pleasant-tasting syrup and in severe cases a few drops of brandy were added. The children soon become accustomed to the burning taste and willingly take the solution. Besides this there is the advantage that the remedy is perfectly harmless and may be given continually for weeks together. The effect of the treatment in cases of average severity is seen in from 3 to 4 hours.

Thymol is recommended by Küster in whooping-cough in a solution of 1 in 2,000. Three or four times a day he directs this solution to be inhaled by means of an atomiser. According to his experience the cases never assume a violent character when this treatment is begun in time; if, however, the attacks are already frequent and violent they soon diminish in number and severity. The duration of the treatment is between three and four weeks, and healthy children who inhale the spray are protected from whooping-cough. Dr. E. Lawrie (*Lancet*, Feb. 16, 1891) reported two cases of chyluria successfully treated with thymol given internally in doses of one grain every four hours, gradually increased to 5 grains.

Description and Properties.—Thymol crystallizes in thin, colourless, rhombic scales, or is seen in commerce in large translucent crystals of spec. grav. 1·028. It melts between 50° and 52° C. to a colourless liquid lighter than water, retains its fluid condition often for a long time, and boils near 230° C. It

has an aromatic thyme-like odour and a warm, pungent but scarcely caustic taste. It dissolves sparingly in water, requiring at 15° C. 1,100 to 1,200 parts for solution, but is soluble in half its weight of alcohol, ether, and chloroform, in 2 parts of soda solution sp. gr. 1·16, and freely in benzol, benzin, carbon disulphide, glacial acetic acid, and fixed and volatile oils. It forms with soda a crystallizable and readily soluble compound, and does not change the colour of a solution of ferric chloride. Symes (1879) ascertained that on being triturated with one-half to ten times its weight of camphor, a colourless syrupy liquid is obtained, but it does not liquefy with chloral hydrate. According to Gerrard, the strongest aqueous solution of thymol available is 1 in 1,000, and a solution of 4 grains of it in a fluid ounce of alcohol is miscible with water without becoming turbid; 3 grains of thymol are dissolved by 1 grain of caustic soda and 1¼ grains of caustic potash. Solid fats, when heated, are excellent solvents of thymol. A solution of 1 part of thymol in 100 parts of warm glycerin remains clear. Thymol is also soluble in 4 parts of cold sulphuric acid; the solution has a yellowish colour, and, on being gently heated, becomes rose-red. On pouring this solution into 10 volumes of water, digesting the mixture with an excess of lead carbonate, and filtering, the liquid becomes violet-blue on the addition of ferric chloride. This reaction is due to *sulphothymolic acid*, $C^{10}H^{14}SO^{4}$, discovered by Lallemand (1853). Hammarsten and Robert (1881) give the following as the most delicate test by which one-millionth of thymol may still be detected: Mix the liquid with one-half of its volume of glacial acetic acid, then with at least an equal volume of sulphuric acid, and warm gently, when a bright reddish-violet colour is produced which is not destroyed by boiling. According to Hirschsohn (1881), a solution of thymol in 60,000 parts of water is rendered turbid by bromine-water, but, according to Hammarsten, the precipitate is not crystalline like tribromophenol. (*Stillé and Maisch.*)

Chemical composition.—The volatile oil of *Thymus Serpyllum*, Linn., according to E. Buri (1879), contains two phenols which do not congeal at—10° C., and of which one imparts a yellowish-

green colour to ferric chloride, and yields a sulphonic acid, the salts of which, like the thymol sulphonates, produce with ferric salts an intense blue colour. Jahns (1880) reported also the presence of a little thymol and carvacrol. Messrs. Schimmel & Co. (Report, April 1891) obtained by distillation of the leaves and stalks 0·3 per cent. of an oil having a very pleasant melissa-like aroma with a slight soupçon of thyme. Its specific gravity at 15° C. was 0·917.

Thymus vulgaris, Linn., is the chief source of thymol in Europe; the essential oil is usually sold under the name of Oleum Origani. For the chemistry of thymol the reader is referred to the article upon *Carum copticum*. (Vol. ii., p. 116.)

Fúdanaj-í-jibali, also called Pudineh-í-kohí, "hill mint," is identified by Mahometan physicians with the Calamintha of the ancients (cf. *Matth. Valgr.* v., 2, 76. *f*), *Calamintha vulgaris*, Sweet, *Eng. Bot.* 1676. We have not met with this drug in the Indian Bazars, but three species of Calamintha occur in the Himalayas.

ZATARIA MULTIFLORA, *Boiss.*

Hab.—Arabia, Persia. The herb in flower.

Vernacular.—Saatar (*Ind. Bazars*).

History, Uses, &c.—The Mahometan physicians of the East identify this drug with the ὀρίγανον of the Greeks, and describe it as having properties similar to those of thyme and mint. Dr. Jayakar of Muscat found the plant in flower in May 1885 on the hills near Muscat in Arabia, and kindly forwarded specimens, which were identified at Kew as *Z. multiflora*. The drug is much used in India in infusion as an agreeable aromatic stimulant and diaphoretic; many other properties are ascribed to it in Persian medical works which it is unnecessary to recapitulate.

Description.—The drug has a fragrant odour like lemon thyme, and consists of small ovate, or nearly round, dotted, entire, rather leathery leaves, the largest of which are about ¼ inch long; mixed with them are portions of a slender woody stem

and numerous minute flowers, forming knotted clusters upon a slender spike; each flower is furnished with a small bract, and when magnified the bracts and calices are seen to be densely covered with jointed hairs. The calyx is unequally 4-cleft, the corolla labiate, and of a red colour, the calyx and flower after being soaked in water for 24 hours only measured $\frac{1}{8}$ inch in length. The leaves when magnified present a mossy surface, which is thickly pitted, each pit containing a granule of red, resinified essential oil.

Chemical composition.—The leaves contain an aromatic essential oil having a minty odour, a red, tasteless, acid resin, and some tannic acid giving a green precipitate with ferric chloride. The bitterness is not due to an alkaloid. The leaves containing 10 per cent. of moisture yielded 13 per cent. of ash.

ZIZIPHORA TENUIOR, *Linn.*

Hab.—Persia, Beluchistan. The herb.

Vernacular.—Mishk-i-taramashia (*Ind. Bazars*).

History, Uses, &c.—The Mahometans of the East identify this plant with the ζυγις or "wild thyme" of the Greeks. It is the مشكطرامشيع of Ibn Sina, who describes it as very hot and dry. Haji Zein in the *Ikhtiarát* states that it is called Rang in Shiraz, and that the milk of goats feeding upon it becomes bloody. He describes it as a valuable expectorant and lithontriptic in doses of one mithkal, but says that it sometimes causes hæmaturia. He also mentions its use by Galen as a suppository in painful affections of the uterus, and by Ishak as a carminative addition to purgative medicines. The drug is also said to be a powerful aphrodisiac. Aitchison states that the peasants in the Harirud Valley and Khorasan call the plant *Kakuti.*

Description.—A very small plant, 2 to 3 inches high; root as long as the plant, single, woody, with a few small fibres. The stems, which are 2 to 5 in number, are also woody, and branch from the ground; they are thickly set with leaves and

flowers, which reach to the apex and form a spike. The leaves are linear-lanceolate, and have several prominent straight veins on each side of the midrib. The calyx, which is purple, encloses four oblong seeds of a brown colour, and is marked with numerous ribs, and ends in five sharply cut claws; it is studded with simple hairs, and is $\frac{5}{16}$ths of an inch long. The odour and taste of the drug is pleasant, like peppermint, but sweeter.

Zufah-i-yabis.* From an examination of the drug it appears to be a small plant, 6 to 8 inches high; stem not thicker than a crow-quill, 4-angled, purplish, branched from the base, which is woody; root woody, seldom branched; flower heads numerous, oblong; calyx striated, hairy, purple, with five sharp teeth; seeds naked, four in number, oblong, 3-angled, of a pale brown, studded with rows of small round tubercles; on one side of the hilum there is a fringe of smaller tubercles very closely set, and on the other two elongated white prominences. As found in commerce the plant is much broken up; it has a pleasant odour like sweet hay. Taste bitter; properties, according to native writers, stimulant, anthelmintic, and deobstruent. The drug is generally attributed to *Hyssopus officinalis*, but this cannot be correct, as the flowers are in oblong spikes. It is imported from Persia.

H. parviflora, *Benth.*, is a native of the temperate Himalaya.

Chemical composition.—Besides tannin, resin, fat, sugar, mucilage, &c., the most important constituent of Hyssop is *oil of hyssop*, of which the fresh herb yields $\frac{1}{4}$ to $\frac{1}{2}$ per cent. It is pale-yellow or greenish, limpid, of about the specific gravity 0·94, and freely soluble in alcohol; it contains oxygen, and commences to boil at 142° C., the boiling-point rising to 180° C. It has the odour and taste of the herb. The *hyssopin* of Herberger (1829) was found by Trommsdorff to be impure sulphate of calcium.

* Sibthorp states that *Satureæa grica*, Linn., is the ὕσσαπο of the modern Greeks, and the زوفه of the Turks. In Sind *Nepeta ciliaris*, Benth., is called Zufah.

Badranjboya, Baklat-el-Utrujiya (*Arab.*). Imported from Persia.

Description.—Calyx striated, hairy, 5-fid, not so long as that of Zúfah-i-yábis, and not coloured; seeds four, naked, brown, 3-angled, nearly smooth, a white patch on each side of the hilum; flowers in axillary clusters of about 6, upon a short peduncle; leaves ovate, margin deeply dentate, somewhat hairy. The drug is always much broken and consists chiefly of stem and fruit; the former is quadrangular, much larger than that of Zúfah, of a purplish tint. Taste bitter, odour faintly aromatic. This herb is supposed to represent the μελισσόφυλλον of Dioscorides and Theophrastus, generally known in Latin as Apiastrum. Virgil (G. 4, 63) calls it Melisphylla, and Theophrastus (4, 25) εὐώδης μελίτεια. It is a plant beloved by bees, the Balm Gentle or *Melissa officinalis* of our gardens. When fresh it has a pleasant lemon odour, which is not retained by the dry plant. It was formerly valued as a corroborant in hypochondriacal affections, and the Persian drug is still used for this purpose by Indian *hakims*. In Europe, Balm tea is still a domestic remedy, and is given as a grateful diluent in febrile affections: it has a place in the French Codex. The different species of Melissa are widely diffused, being found in Europe, Central Asia, and North America.

Chemical composition.—The leaves of *M. officinalis* contain, besides the common constituents of plants, a small quantity of tannin and bitter principle, and about $\frac{1}{8}$ to $\frac{1}{4}$ per cent. of volatile oil, which is colourless or yellowish, has a specific gravity of about 0·89; dissolves in about 5 parts of alcohol, sp. gr. 0·85, and contains a stearopten.

MARRUBIUM VULGARE, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 1224, *f.* 1; *Eng. Bot.*, 410; *Bentl. and Trim.*, 210. Common White Horehound (*Eng.*), Marrube blanc (*Fr.*).

Hab.—Western Temperate Himalaya to Europe. The herb.

Vernacular.— Farásiyún (*Ind. Bazars*).

History, Uses, &c.—This plant is the πράσιον of Theophrastus (vi., 2), who mentions two kinds. Dioscorides (iii., 110) relates its medicinal uses, which are also noticed by Hippocrates (681, 3), Celsus (v., 11), and Pliny (20, 89). The ancients considered it to be a general stimulant, expectorant, deobstruent, carminative and local anodyne. Horehound has still a considerable reputation in Europe as a remedy for chronic bronchitis with copious expectoration, and as a stomachic tonic in dyspepsia. It was also formerly prescribed in chronic rheumatism, hepatic and uterine obstructions and ague, the usual dose being from ½ to 1 drachm of the dried herb. The ancients used the expressed juice with honey, both internally and as a local application to foul ulcers and diseased mucous surfaces.

Horehound is the Farásiyún of Ibn Sina and other Arabian physicians, who reproduce the account given by Dioscorides of its medicinal uses. Hakim Ali Giláni, in his commentary upon the Kánun, gives Súf-el-ard, "earth wool," and Hashishat-el-kalb, "dogs' herb," as Arabic names for the plant; he says that dogs always piss on smelling it.

Owing to the similarity between the Greek words πράσιον and πράσον some Mahometan physicians have fallen into the error of supposing the drug to be an alliaceous plant. Hakim Muatamid-el-muluk Syud Alvikhán points out this error, but falls into another, inasmuch as he identifies it with Arusa (*Adhatoda Vasica*). Mahometan writers also mention a second kind of Farásiyún called *Balúti*; this is our Black Horehound (*Ballota nigra*, Linn.).

M. vulgare is a common plant in Persia; Aitchison observed it growing abundantly in Khorasan. In the bazars of the plains of India it is not obtainable; if demanded, either Arusa, or a kind of squill called Farásiyún-i-piyázi, is supplied.

Description.—The branching stem is about a foot high, quadrangular, much-branched, and covered with a white felt. The leaves are opposite, petiolate, about an inch long, roundish-ovate, somewhat heart-shaped or rounded at the base, obtuse, serrate or coarsely crenate, wrinkled by the prominent veins

below, pale-green and downy above and hoary beneath. The flowers are in dense axillary whorls, with woolly, linear, and hooked bracts, a tubular ten-ribbed calyx divided into ten short, spreading, stiff, and hooked teeth, and a white bilabiate corolla enclosing four stamens. The four achenes are dark-brown.

The herb has a peculiar aromatic and somewhat musky odour and a pungent bitter taste; if kept for any time, the aroma disappears.

Chemical composition.--The plant has been recently examined by J. W. Morrison (*Am. Journ. Pharm.*, 1890, p. 327). A proximate analysis gave the following result:—

	Per cent.
Fat, wax and traces of volatile oil	2·05
Crystalline compound, soluble in ether	·48
Chlorophyl and fat	2·29
Resin and bitter compounds, soluble in absolute alcohol	1·94
Mucilage	4·94
Glucose	·67
Extractive, soluble in water	5·93
Albuminoids	4·48
Pectin and undetermined	5·93
Pararabin	2·30
Cellulose and lignin	37·48
Moisture	6·72
Ash	24 30
Loss	·49

The fat was soluble in hot 95 per cent. alcohol, and melted at 46° C. The wax was insoluble in this solvent, but dissolved in carbon bisulphide. The crystalline principle was extracted from the drug with stronger ether, and purified by repeated crystallization from hot 95 per cent. alcohol, with one or more treatments with animal charcoal. The crystals were insoluble

in water and in solution of potassium hydrate, very sparingly soluble in boiling water and in cold alcohol. Soluble in hot 95 per cent. alcohol, also in ether and chloroform. They melted at 152° to 153° C. They were at first tasteless, but developed, when held on the tongue, a decided bitterness. The alcoholic solution was very bitter.

Sulphuric or nitric acid gave a dark-brown colour, hydrochloric acid produced no change and ferric chloride produced no change.

This principle reduced Fehling's solution slightly by boiling, without first being treated with an acid. On boiling it first with acidulated water a peculiar aromatic odour was developed, then on heating with Fehling's solution an abundant precipitate of cuprous oxide was produced, thus showing it to be an easily decomposable glucoside.

A small quantity of a bitter principle was extracted from the drug by absolute alcohol, along with the resin. This appeared to be different from the previous one extracted by ether, and for the purpose of further investigation, a larger quantity of the drug was exhausted with ether, the solvent recovered and the residue treated with petroleum ether to remove fat and wax. The remaining portion was dissolved in hot alcohol, treated with animal charcoal and crystallized. The crystals were purified by repeated crystallization and treatment with animal charcoal. Melting point, 152° to 153° C.

The average of two combustions was:—

	Found.	Calculated for. ($C^{40}H^{58}O^{9}$)
C	70·25	70·38
H	8·42	8·50
O	21·33	21·12
	100·00	100·00

Three samples of crystals, presented with a thesis of last year by Frederick G. Hertel, Ph.G. (*American Journal of Pharmacy*, 1890, p. 273), and obtained by him from the fluid extract, were

also examined. One of these, which he had crystallized from cold alcohol, melted at 153·5° to 154·5° C., was evidently nearly pure; the average of three combustions gave:—

C	70·54
H	9·08
O	20·38
	100·00

The other samples were evidently the same compound in an impurer condition, as was found by combustion and melting point. The author here remarks:—

"This compound as well as that obtained by myself is evidently the marrubiin discovered by Mein in 1855. Harm (*Archiv der Pharmacie*, No. 83, p. 144) stated the melting point to be 148°C.

"In a later communication (No. 116, page 41), on elementary analysis he found the substance to contain 8·52 per cent. of hydrogen and more than 69 per cent. of carbon.

"Kromayer (*Archiv der Pharmacie,* No. 108, p. 257) gives the yield of marrubiin as about 2 grams from 25 pounds of the drug, and states the melting point to be about 160°C., and that it is not a glucoside. My results indicate its composition to be very close to that of absinthiin, $C^{40}H^{56}O^{8}$, but they do not agree with all the properties of that substance as described by Kromayer in the same journal (No. 108, p. 20), who states that absinthiin melts at 120° to 125° C. Many of the properties, however, are common to both substances, prominent among which are,—solubility, taste, grittiness between the teeth, crystalline appearance and percentage composition."

The larger portion of the drug, after exhaustion with ether, was extracted with methyl alcohol, the solvent recovered, and the residue treated with water and filtered.

The filtrate, on agitation successively with ether and chloroform, yielded to the former a very bitter greenish substance

with a narcotic odour, and to the latter a brownish substance with a bitter and puugent taste. Both gave negative results when tested for alkaloids and both reduced Fehling's solution, especially after heating with dilute acid, during which process each developed a peculiar aromatic odour. These results point to the presence of two bitter principles besides marrubiin, which is in agreement with Hertel's statement, that after the separation of marrubiin the fluid extract appeared to be as bitter as before.

Anisomeles malabarica, *Br. Bot. Mag., t.* 2071; *Wight Ic., t.* 164, is well known in Southern India, where it is called Peyameratti in Tamil and Mogbira in Telugu. Rumphius, speaking of the juice of the plant, says:—"Idem quoque succus cum binis guttis olei sesamini propinatus, prodest mirifice asthmaticis, vel tussi mala laborantibus, quem in finem syrupus quoque præparatur ex foliorum succo cum saccharo cocto." (*Hort. Amb. v.*, 8, 65.) It is a native of Malabar, where it is called Karintoomba, and is noticed by Rheede. (*Hort. Mal. x.*, p. 185, *t.* 93.) Wight, Ainslie, and others mention that an infusion of the leaves is given to children in colic, dyspepsia, and fever arising from teething; in ague an infusion of the leaves is used to promote perspiration; a decoction of the plant, or the essential oil distilled from it, is used externally in rheumatism. The plant appears to have medicinal properties very similar to those of Horehound.

Description.—Shrubby, 2 to 5 feet; branches obtuse angled; leaves ovate-lanceolate, crenately serrated at the upper part, entire below, about 5 inches long, and 1½ inch broad; calyx 5-cleft, thickly covered with long white rather viscid pubescence; upper lip of corolla entire, white, under one 3-cleft with the lateral divisions reflexed; anthers deep purple; whorls disposed in simple racemes.

LEUCAS ASPERA, *Spreng.*

Fig.—*Rheede, Hort. Mal. x., t.* 91.

Hab.—Plains of India. The herb.

LEUCAS LINIFOLIA, *Spreng.*

Fig.—*Jacq. Ic. Pl. Rar.* i., 11, *t.* 111; *Rumph. Herb. Amb.* vi., *t.* 16, *f.* 1.

Hab.—Plains of India. The herb.

LEUCAS ZEYLANICA, *Br.*

Fig.—*Wight Ill.*, *t.* 176. Herbe Tombée (*Fr.*).

Hab.—Assam to Ceylon. The herb.

LEUCAS CEPHALOTES, *Spreng.*

Fig.—*Wight Ic.*, *t.* 337; *Desf. in Mem. Mus.* xi., 8, *t.* 4.

Hab.—Himalaya. Plains of N. India and Deccan. The herb.

Vernacular.—Túmba-phúl, Kúmbha-phúl, Bahúphúli (*Mar.*), Goma, Madha-páti (*Hind.*), Tigadi (*Can.*), Kúbo, Kúlán-nú-phúl (*Guz.*), Tumba (*Mal.*), Gul-dora, Chatra (*Punj.*), Halkasa (*Beng.*), Tumi (*Tel.*).

History, Uses, &c.—At least four species of Leucas are used in Hindu medicine under the Sanskrit name of *Drona-pushpi* or "cup-flower," so called from the resemblance of the calyx of these plants to a little cup. The synonyms for these plants are *Kumbha-yoni*, *Kurumba*, *Kharva-yattra*, *Chitra-pattrika*, *Chitrákshupa* and *Su-pushpa;* they are described in the Nighantas as heavy, dry, sweet, hot, and aperient, generators of wind and bile, and are prescribed for jaundice and to expel phlegmatic humors and worms; they are also considered to be stimulant and diaphoretic.

In the cough or catarrh of children, *Tumba* juice 1 part, with 2 parts of honey and a few grains of Borax, may be mixed, and a few drops given occasionally, and in intestinal catarrh 6 drops of the juice may be given with a little powdered *Khárik* (dry dates).

These plants are also used in Hindu ritual; during the ceremonial bath, early in the morning on the *Naraka Chaturdasi*, or first day of the *Divali*, the religious manuals direct the whirling round the body, while bathing, of a sprig of *Drona-pushpi* of *Achyranthes aspera* (*apámárga*), and of *Cassia Tora* (*prapunáta*), cf. Vol. II., p. 65. The Mahometan physicians have given these plants the name of *Sisáliyús*, and use them as a substitute for the true *Sisáliyús* (*Myrrhis odorata*), as stimulant diaphoretics. Rheede notices the use of *L. aspera* in Malabar, and the same species is given in amenorrhœa at Réunion. Under the name of *Herba admirationis* a species of Leucas, probably *L. linifolia*, is described by Rumphius. In Western India *L. zeylanica* is much used, and in the Punjab *L. cephalotes*. These plants are a popular local application to itch and mange, and the juice of the leaves snuffed up by the nostrils is used as a remedy in snake-bites, and for headache and colds. An infusion is known as an insecticide, and planters and others on the Nilgiris find that blight and insect pests may be kept away from trees by a diligent application of this remedy. The flowers are offered in the Hindu temples. In Réunion *L. zeylanica* is known as *Herbe Tombée*, and is considered to be stimulant and antirheumatic.

Description.—*L. aspera* is annual, erect or diffuse, stem stout, hispid or scabrid, leaves 1 to 3 inches, linear or oblong obtuse, entire or crenate, whorls large, terminal and axillary, bracts long, linear and filiform, calyx ¼ to ⅜ of an inch, tubular, curved, smooth below, green and ribbed and scabrid above, contracted above the nutlets, mouth small, glabrous, very oblique, shortly and irregularly toothed, flowers small, white. *L. linifolia* and *L. zeylanica* are very similar plants, and *L. cephalotes* has very large terminal and globose whorls of flowers. These plants have an odour recalling that of the Dead-nettle (*Lamium album*), but *L. aspera* is more fragrant than the others.

Chemical composition.—The herb of *L. zeylanica* on distillation afforded a very small quantity of essential oil. By boiling a decoction of the herb with soda solution a strong odour was

given off, and on condensing the vapour, ammonia and a volatile alkaloid were detected in the distillate. The alkaloid was combined in the plant with an acid giving a green colour with ferric salts. The air-dried plant afforded 7·3 per cent. of ash.

Leonotis nepetæfolia, *Br. Bot. Reg.*, *t.* 281; *Wight Ic.*, *t.* 867; *Vern.*—Hejur-chei (*Beng.*), Mátijer, Mátisúl (*Guz.*), Dípmal (*Mar.*), is a large and conspicuous annual common in the neighbourhood of villages throughout the hotter parts of India. It is easily recognised by its globular spinous heads of orange-coloured flowers. Roxburgh gives the following description of the plant:—"Stem annual, straight, four-sided, simple, from 4 to 6 feet high. Leaves opposite, spreading, petioled, cordate, serrate, pointed, downy, from 4 to 8 inches long, and 2 to 3 broad. Floral leaves (*bractes verticillorum*) lanceolate, depending. Petioles channelled, winged with the decurrent leaf; verticels globular, 2, 3 or 4, towards the apex of the plant about 5 inches asunder. Involucres many, subulate. Flowers numerous, of a deep rich orange colour. Calyx, 10-striated, 8-toothed; corol, under lip very short, 3-toothed, at all times of a dirty withered colour."

The ashes of the flower-heads mixed with curds are applied to ringworm and other itchy diseases of the skin. Dr. A. J. Amadeo states that it is called *Rascamoño* in Porto-Rico, and that a decoction of the leaves is used as a tonic, the juice is also expressed and taken with limejuice and rum as a febrifuge. Dr. Amadeo has used it in combination with *Phyllanthus Niruri* in intermittents.

Buliun (πολίον), the Poly-Germander (*Teucrium Polium*, L.), **Iskurdiyun** (σκορδίον), the Water-Germander (*T. Scordium*), and **Kamazariyus** (χαμάιδρυς), the Wall-Germander (*T. Chamædrys*), are treated of in the Materia Medica of the Indian Mahometan physicians, but none of these plants are, as far as our experience goes, obtainable in the bazars, although *T. Scordium* is a native of the Western Himalaya and Cashmere. This plant has an odour of garlic, and is one of the ingredients in the

Tiryák-i-Farúk or *Theriaca Andromachi*, which is still sold in the bazars of India. *T. Polium* is a native of Persia, and was found by Aitchison in Khorasan, but he did not observe that it was used medicinally. He also notices *T. serratum*, Benth., as having a strong odour of asafœtida. *T. Chamædrys* was formerly used in Europe as a remedy for gout, and was an ingredient in the celebrated antiarthritic or Portland powder.

PLANTAGINEÆ.

PLANTAGO OVATA, *Forsk.*

Fig.—*Bentl. and Trim.*, *t.* 211. Syn. *P. Ispaghula.*

Hab.—Punjab, Sind, Persia. The seeds. Spogel seeds (*Eng.*).

Vernacular.—Isbaghol (*Hind.*), Esabgol (*Mar.*), Eshopghol (*Beng.*), Esopgol, Uthamu-jirun (*Guz.*), Ishappukol-virai (*Tam.*), Isapagála-vittulu (*Tel.*), Isabakolu (*Can.*).

History, Uses, &c.—The seeds are not mentioned by the old Hindu writers, but the Guzerathi name appears to be of Sanskrit origin. In all the vernaculars corruptions of the Persian name *Ispaghúl* are in use. This word is a compound of اسپ "a horse," and غول "the ear," in allusion to the shape of the seeds. In Mahometan works the seeds will be found described under the name of *Bazr-i-Katúna.* The author of the *Makhzan* states that *Kaliún* is the Greek, *Isparzah* the Isfaháni, and *Bangúst* and *Shikam-daridah* the Shirazi names for them. In India, they are considered to be cooling and demulcent, and useful in inflammatory and bilious derangements of the digestive organs. The crushed seeds made into a poultice with vinegar and oil are applied to rheumatic and gouty swellings. With the mucilage a cooling lotion for the head is made. Two to three dirhems moistened with hot water and mixed with sugar are given in dysentery and irritation of the intestinal

canal to procure an easy stool. The decoction is prescribed in cough. The roasted seeds have an astringent effect, and are useful in irritation of the bowels in children, and in dysentery. The natives have an idea that the powdered seeds are injurious, and consequently always administer them whole. Fleming, Twining, Ainslie, and others speak very favourably of the use of *Ispaghúl* in the treatment of chronic diarrhœa. Twining gives the dose for an adult as 2½ drachms mixed with half a drachm of sugar-candy. (*Diseases of Bengal*, Vol. I., p. 212.) In the *Pharmacopœia of India* the seeds have been made official, and directions are given for the preparation of a decoction.

Description.—The seeds are boat-shaped, about ⅛ of an inch long and rather less than $\frac{1}{16}$ broad, translucent, with a pinkish tinge and a faint brown streak upon the convex side. The concavity is covered with a thin white membrane. Soaked in water they become coated with an abundant adherent mucilage which is free from taste and odour. The epidermis of the seeds is composed of polyhedral cells, the walls of which are thickened by secondary deposits, the source of the mucilage; between it and the albumen is a thin brownish layer. The albumen is formed of thick walled cells which contain granular matter.

P. amplexicaulis, *Cav. Ic. ii., t.* 125, a plant of the Punjab Plains, Malwa and Sind, extending to Southern Europe, furnishes the brown *Ispaghúl* not unfrequently to be met with in the Indian bazars. The seeds have the same boat-shaped form as those of *P. ovata*, but are rather larger, averaging ⅙ of an inch in length. They are probably as efficient as the true Ispaghúl seeds.

Commerce.—Large quantities of these seeds are imported into Bombay from Persia. Value, Rs. 4 per maund of 37½ lbs.

They differ in colour, some being brown and some nearly white with a pinkish tinge; the latter are preferred.

PLANTAGO MAJOR, *Linn.*

Fig.—*Wight Ill., t.* 177; *Eng. Bot.*, 1558. Greater Plantain (*Eng.*), Grand Plantain (*Fr.*).

Hab.—Temperate India, Persia, Europe. The seeds.

Vernacular.—Bártang, Bárhang (*Indian bazars*).

History, Uses, &c.—Under the name of αρνογλωσσον Dioscorides describes two varieties of Plantago, the greater and the lesser, and states that the first is the best and most generally used. These plants were known to the Romans as Plantago, and according to Sibthorp are the *P. lagopus* and *P. altissima* of modern botany; they were considered to be very effectual in arresting the fluxes known by the Greeks as "rheumatismi," or "griping pains in the bowels" (*Plin.* 25, 39; 26, 47). The leaves and roots were considered to be astringent and febrifuge (*Galen*). The Arabian physicians describe them under the name of Lisán-el-hamal, and state that they are the Sabaat-azlaa and Kasrat-el-azlaa of Dioscorides (Arabic translations of ἑπτάπλευρον, and πολύνευρον) meaning '*seven-ribbed and many-ribbed*'; they repeat what the Greeks have written with a few trifling additions. The seeds of *P. major* are largely imported into India from Persia, and have a great reputation as a remedy for dysentery. Valentine Baker states that he was cured by these seeds when suffering from the disease during his travels in Khorasan. The root and leaves are still in use in Europe as domestic remedies on account of their mucilaginous properties.

The seeds of **P. Psyllium**, *Linn.*, a native of the N. W. Punjab, extending to Southern Europe, are used in a similar manner. This plant is often stated to be the source of the Persian Bárhang, but we have always obtained *P. major* by sowing these seeds.

Description.—The seeds are minute, oblong and brown, marked with waved, slightly elevated, longitudinal ridges of a darker colour; one side is arched, the other concave and marked

with a scar showing the attachment to the ovary. They are insipid, and have an oily smell when crushed. Soaked in water they become coated with a transparent mucilage.

Chemical composition.—The leaves of *P. major* have been examined chemically by Dr. Rosenbaum, but the results obtained do not indicate any active principle. He found that petroleum benzine extracted 4 per cent. of wax and chlorophyll, the extract fusing at 83° C. Ether dissolved 4·4 per cent. of resin and chlorophyll. Alcohol extracted 10 per cent., of which 6 per cent. was soluble in water and contained a considerable amount of sugar; the remaining four parts were soluble in ammonia. Water took up 13 per cent., of which 7·2 per cent. was insoluble in 66 per cent. alcohol. Soda solution dissolved 6 per cent., and diluted acid 10 per cent., the latter containing a notable quantity of calcium oxalate. It may be noted here that Th. Koller, in 1868, found citric acid and oxalic acid in the three species, *P. major*, *P. lanceolata*, and *P. media*, besides the ordinary plant constituents, chlorophyll, resin, wax, albumen, and pectin. These constituents do not account for the reputation as a styptic and vulnerary in which the plant was held by ancient writers. The presence of sugar indicates the possibility of a glucoside being contained in the plant. The value of the seeds in diarrhœa and dysentery is no doubt due in some measure to the quantity of mucilage they afford. (*Amer. Journ. Pharm.*, Sept., 1886.)

Plantago mucilage is neutral in reaction, is not altered by iodine or precipitated by borax, alcohol, or perchloride of iron. It is only sparingly soluble in water. R. W. Bauer separated the carbohydrate *xylose* (previously obtained from wood-gum) from the epidermis of *P. Psyllium*, by boiling the aqueous extract with dilute sulphuric acid. It was identified by its melting point, rotatory power, and by its compound with phenylhydrazine. Wood-gum can be obtained from beech wood, jute, or deal, by extracting with 5 per cent. soda and precipitating with alcohol and HCl. When this is hydrolysed, it yields Koch's wood-sugar or xylose. Xylose closely resembles arabinose in all its properties, and, like the

latter, is dextrorotatory; when treated with acids, it yields considerable quantities of furfuramide, but no levulose. The phenyl-osazone has the composition $C^{17}H^{20}N^4O^3$, so that xylose is a penta-glucose $C^5H^{10}O^5$. When treated with nitric acid, it is converted into acids containing 4 or 5 atoms of carbon. Xylose and arabinose, and all substances from which they can be obtained, give the cherry-red coloration of arabin when warmed with phloroglucinol and hydrochloric acid. This reaction can be employed for the detection of xylose and arabinose. (*Journ. Chem. Soc.*, LVI., pp. 233, 847.)

NYCTAGINEÆ.

BOERHAAVIA REPENS, *Linn.*

Fig.—*Delile, Fl. Eg., t.* 3, *f.* 1; *Wight Ic., t.* 874; *Rheede, Hort. Mal. vii., t.* 56. Spreading Hogweed (*Eng.*), Patagon (*Fr.*).

Hab.—Throughout India. The herb and root.

Vernacular.—Sánt, Thikrí (*Hind.*), Purna, Punarnaba (*Beng.*), Khápra, Punanava, Kálivasu, Ghetulí (*Mar.*), Múkku-rattai (*Tam.*), Atíka-mámidi (*Tel.*), Vakha-khaparo, Sátodí-mula (*Guz.*), Ganajali, Biléganjali (*Can.*).

History, Uses, &c.—This plant is called by Sanskrit medical writers Punar-nava, Punar-bhava, and Punar-bhu, on account of its perennial habit, and Sothagni from its use as a remedy for dropsy. It is described in the Nighantas as pungent, dry, hot, sweet and bitter, and is recommended as a laxative, diuretic, and stomachic in jaundice, strangury, dropsy, and internal inflammations. A compound decoction, *Punarnavashtaka*, is made of the roots, dried Neem bark, leaves of *Trichosanthes dioica*, dried ginger, root of *Picrorhiza Kurrooa*, chebulic myrobalans, stem of *Tinospora cordifolia*, and dried wood of *Berberis* (Dárhalad), each one quarter tola, water 32 tolas, boiled

down to one-fourth, which is to be taken during the 24 hours. An oil and electuary are also used.

Ainslie mentions the use of the root in powder, in the quantity of a teaspoonful twice daily, as a laxative. In the *Pharmacopœia of India* its successful use as an expectorant in asthma is noticed, and it is said to act as an emetic when given in large doses. This has been confirmed by the experience of the French in the Antilles, where the plant is called *Patagon* or *Patagonelle-Valeriane.* In Western India the herb is used as a diuretic in gonorrhœa, and as an external application the pounded leaves are applied to dropsical swellings. In the rainy season, when luxuriant, it is eaten as a potherb, after having been well boiled to remove its medicinal properties. The use of the root in gonorrhœa appears to have been introduced by the Portuguese; in the West Indies the plant is known as *Bejuco de purgacion,* and is the popular remedy for that disease. A decoction (1 oz. to a pint of water) is used in doses of a wineglassful every hour.

Description.—A common creeping weed on waste ground and roadsides; stalks numerous, about two feet long, slender, procumbent; leaves cordate-ovate, unequal, opposite, edges waved, tinged with red; flowers small, sessile on the apex of the pedicels, peduncles from the axils and ends of the branches; fruit oblong, dull green, or brownish, viscid, about the size of a caraway, longitudinally 5-grooved, studded all over with glandular hairs; root twisted, often as thick as the finger when fresh, whitish, fleshy, 2 to 3-branched, a foot long or more; taste bitterish, nauseous. A microscopic section shows that the parenchyme is loaded with needle-shaped crystals, otherwise there is nothing peculiar.

There are two varieties of the plant, one with white and the other with red flowers; in Bengal the former is called Svetapurna and the latter Gudha-purna.

Chemical composition.—The whole plant was used for the examination, and, with the exception of minute traces of a principle soluble in ether, and affording reactions with

alkaloidal reagents, nothing of interest was detected. No principle reacting with ferric salts was present.

MIRABILIS JALAPA, *Linn.*

Fig.—*Bot. Mag., t.* 371 ; *Rheede, Hort. Mal.x., t.* 75. Marvel of Peru (*Eng.*), Belle de nuit (*Fr.*).

Hab.—West Indies. Cultivated in India. The leaves and root.

Vernacular.—Gul A'bbás (*Pers., Ind.*), Kríshna-keli (*Beng.*), Anthinarlu, Patharachi (*Tam.*), Batharachi (*Tel.*), Madhyánhamallige (*Can.*), Antimalari (*Mal.*), Gulbás, Gulbas (*Mar.*).

History, Uses, &c.—Five varieties of this plant, with red, white, yellow, red and white, and red and yellow flowers, were introduced from the West Indies in 1596, and must have been carried by the Portuguese to the East shortly afterwards, as the plant is said to have been introduced into Persia in the reign of Shah Abbas the first, and was established on the Malabar Coast in the time of Van Rheede. It was at one time supposed to produce the Jalap of commerce. *M. Jalapa* has been given the Sanskrit name of Sandhyakali, or "evening flower," but is best known by its Persian name of Gul A'bbas, or "flower of A'bbás"; it is a favorite flower of the Persians, who cultivate it in ornamental flower pots. The Arabs call it Shab-el-leili, which is evidently a translation of the French "belle de nuit"; it is the *Fula quadrohoras*, or "four o'clock flower," of the Portuguese, as its flowers open at that hour in the afternoon.

In India the leaves boiled in water are applied as a maturant to boils and buboes, and the juice, which is considered to be very cooling, is applied to the body to allay the heat and itching in the urticaria arising from dyspepsia; the *U. febrilis* or *U. ab ingestis* of European physicians, which the Hindus consider to be caused by bile in the blood. The seeds are said to be sometimes used to adulterate black pepper. The root is said to be a mild purgative,

but Loureiro remarks, "Hæc radix non est apta ad medicinam, nisi per aliquot annos in viva planta senescat; tuncque sit subrotunda, rugosa, exterius subnigra, intus fusco-pallida, circulis concentricis nigricantibus distincta." In the Concan the dried root powdered, and fried in *ghi* with spices, is given with milk as a *paushtik* or strengthening medicine, and rubbed down with water to a paste it is applied to contusions.

Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*,Oct. 1889) states that in Tanjore the roots boiled and made into curry are considered beneficial to those who suffer from piles, and that a powder and confection are also in use. The powder contains five drachms of root, two and a half each of long and black pepper, and five ounces of sugar. Dose ʒi, twice daily. The confection has the same quantity of root with 2½ drachms each of nutmeg, mace, and Atis root, *ghi* 1 oz., sugar and milk of each 10 ounces. Dose as above.

Dr. Mootooswamy finds the root to act as an astringent in these preparations. Ainslie, quoting Fleming (*Cat.*, p. 29), states that the root was tried as a purgative by Drs. Hunter and Shoolbred, but found to have so feeble a purgative action as to be useless. He also tried it himself with the same result. According to Thunberg, the Japanese prepare a kind of white paint for their complexions from the seeds.

Description.—The root of young plants is cylindrical above and tapering below, but in old plants it becomes napiform or subrotund, the external surface is dark brown and marked with numerous circular rings; internally it is dirty white or greyish. When dry, very old roots become hard, compact and heavy, and deepen in colour, but younger roots are of a leathery consistence. It has a faintly nauseous odour, and a sweetish, subacrid taste. A transverse section of the root shows numerous concentric rings of a darker colour than the intervening substance; it shows numerous acicular crystals when magnified.

Chemical composition.—The roots were collected in July, cut into slices, and exposed to warm air, then reduced to powder and the desiccation completed at 100° C.

The fresh roots dried over sulphuric acid lost 81·136 per cent. in weight; the ash amounted to 6·135 per cent., and was free from manganese.

The proximate analysis was made with the powdered roots dried at 100° C., and was conducted according to Dragendorff's plan with the following results :—

Light petroleum ether extract..................		0·580 per cent.
Ether extract, soluble in water	0·09 per cent.	
alcohol	0·222 ,,	
Residue insoluble in water or alcohol	0·028 ,,	0·340 ,,
Absolute alcohol extract		3·040 ,,
Aqueous extract containing glucose 1·6 per cent., saccharose or allied carbohydrate 7·97 per cent.		30·62 ,,

The petroleum ether extractive was soft and pale yellowish in colour, non-crystalline, and without any special odour. It consisted of wax, and a pale yellow oil, soluble in absolute alcohol with neutral reaction.

The ethereal extract was soft and yellowish. The portion soluble in water had an acid reaction, but gave no coloration with ferric chloride. Acidulated with sulphuric acid a slight precipitate was afforded with Mayer's reagent. The residue of the ethereal extract soluble in alcohol was also yellowish, soft' and on standing became indistinctly crystalline. Treated with water acidulated with sulphuric acid it gave no alkaloidal reactions; with alkalies on gently warming it was slightly soluble, with pale yellow coloration: the colour being destroyed by acids, and whitish flocks precipitated.

The alcoholic tincture of the roots was of a port-wine colour, and the extract of a deep orange tint. In water part was soluble with acid reaction, and afforded a precipitate with alkaloidal reagents. The extract was treated with ammonia, in which the greater part dissolved, affording a dirty brownish-red solution, and the solution agitated with ether: the ethereal extract

amounted to 0·384 per cent. and contained a small amount of alkaloid with much colouring matter. An attempt was made to purify the alkaloid by reagitating this extract from an acid solution with ether, and then neutralizing and again agitating with ether; an unweighable amount of the alkaloid was, however, obtained. No special colour reactions of the alkaloid were noted. An alkaline solution of the alcoholic extract was only slightly precipitated by acids, the solution remaining dark-coloured. The aqueous extract contained 1·6 per cent. of glucose calculated on the roots dried at 100°C. After boiling with dilute sulphuric acid a second determination with Fehling's solution was made, and the result calculated as saccharose, which was equivalent to 7·97 per cent.

In order to determine whether the plant had any injurious properties, the alcoholic extract from 10 grams of the dried and pounded roots was mixed with a few drops of ammonia and water and injected into a cat's stomach; the cat vomited once, but was not otherwise inconvenienced.

AMARANTACEÆ.

ACHYRANTHES ASPERA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1780. Prickly Chaff-flower (*Eng.*).

Hab.—Throughout India and tropical Asia. The herb.

Vernacular.—Unga, Latchira, Chirchira (*Hind.*), Apang (*Beng.*)., Pándhara-ághada, Ághada (*Mar.*), Sufed-ághado (*Guz.*), Na-yurivi (*Tam.*), Uttareni, Antisha (*Tel.*), Uttaráni, Uttaréni (*Can.*), Kataláti (*Mal.*).

History, Uses, &c.—This plant has given a name to the sacrificial offering called *Apamarga Homa*, which consisted of a handful of the flour of the seeds offered at daybreak, but which is not now, as far as we know, practised in India. According to the Black Yajurveda, Indra, having killed Vritra and other demons, was overcome by Namuchi and made peace with him, promising never to kill him with any solid or liquid, neither by day nor by night. But Indra collected some foam, which is

neither solid nor liquid, and killed Nàmuchi in the morning between night and daybreak. From the head of the demon sprung the herb Apamarga, with the assistance of which Indra was able to kill all demons. Hence this plant has the reputation of being a powerful talisman, and is now popularly supposed to act as a safeguard against scorpions and snakes by paralysing them.* It is waved round the body whilst taking the ceremonial bath early in the morning on the Naraka Chaturdasi or first day of the Diváli (new year) festival.

The Sanskrit synonyms for the plant are Shikhari, Kini or Kinihi, Khara-manjari "having a rough flower-stalk," Adhva-shalya "roadside rice," Shaikharika, Pratyak-pushpi "having reverted flowers," and Mayuraka "crested." It is described in the Nighantas as purgative, pungent, digestive; a remedy for phlegm, wind, inflammation of the internal organs, piles, itch, abdominal enlargements, and enlarged cervical glands. The ashes are used by the Hindus in preparing caustic alkaline preparations. The diuretic properties of the plant are well known to the natives of India, and European physicians agree as to its value in dropsical affections; one ounce of the plant may be boiled in ten ounces of water for 15 minutes, and from 1 to 2 ounces of the decoction be given 3 times a day. (*Pharm. of India*, p. 184.)

Different parts of the plant are ingredients in many native prescriptions in combination with more active remedies.

In Western India the juice is applied to relieve toothache. The ashes with honey are given to relieve cough; the root in doses of one tolá is given at bedtime for night blindness, and rubbed into a paste with water it is used as an *anjan* (eye salve) in opacities of the cornea. The seeds are often used as a famine food in India, especially in Rájputana, where the plant is called Bharotha, भरोठा (grass).

Description.—A common weed, with an erect, striated pubescent stem, generally about two feet high, but sometimes much more. Side branches in pairs, spreading; leaves pubescent

* Compare with Scribonius Comp. 163, 164, where similar superstitions are recorded.

from the presence of a thick coat of long simple hairs, obovate, undulated, very obtuse, acuminated, base attenuated; petiole short; spikes long, lax; flowers green; bracts rigid, prickly. Sections of the stem do not show any crystalline deposit in the parenchyma. The seeds are oblong, of a brown colour, from $\frac{1}{10}$ to $\frac{1}{8}$ of an inch in length; on one side a grooved prominence is seen which indicates the position of the embryo where it curves round the mealy albumen. The starch granules are very small, and are so closely packed that the large irregular-shaped cells which contain them have almost the appearance of parenchymatous cells.

Chemical composition.—The whole plant collected in August was used. A proximate analysis failed to indicate the presence of any principle of special interest. No alkaloidal body was detected, and the alcoholic extract contained no principle reacting with ferric salts.

For the ash determination, the roots, stems and leaves were separately examined with the following results:—

	Leaves.	Stems.	Roots.
P_2O_5	3·0257	2·6939	1·8594
SiO_2 as Sand	39·7192	12·9716	21·4219
SO_3	1·3200	2·6534	3·9523
CaO	13·8893	13·1233	12·9335
MgO	3·4778	3·5149	5·4419
K_2O	17·8454	32·0008	28·5830
Na_2O	......	......	·9860
Fe_2O_3	2·7931	3·0352	5 6297
Manganese	Traces, not estimated.	Not estimated.	Not estimated.
KCl	5·7416	9·5221	......
NaCl	1·1770	1·5261	3·2951
Al_2O_3	2·0651	Not estimated.	Not estimated.
CO_2	8·8687	13·6294	11·0057
Carbon	·3297	·5525	Not estimated.
	100·2526	95·2232	95·1085

The leaves, stems, and roots dried at 100°C. afforded respectively the following percentages of ash :—Leaves, 24·334 ; stems, 8·672 ; roots, 8·863. The large amount of sand present in the ash is due to the fact of the plants having been collected during the rains, and when received they were coated with finely divided silicious matter.

The total potash calculated as K^2O was equivalent in the leaves to 21·4986 per cent., in the stems to 38·0122 per cent., and in the roots to 28·5830 per cent. It is possible that the plant might be of value as a cheap green manure on account of its potash content. (*Warden, Chem. News*, Vol. ii., 1891).

Amarantus spinosus, *Linn., Willd. Amar.* 38, *t.* 4, *f.* 8; *Vern.*—Tanduliya (*Sans.*), Kántemáth (*Bomb.*), Kántanatia (*Beng.*), Mulluk-kirai (*Tam.*), Kántálo-dambho (*Guz.*), possesses mucilaginous properties. The Hindu physicians prescribe the root in combination with other drugs in menorrhagia. It is considered to be a specific for colic. A poultice of the leaves was officinal in the *Bengal Pharmacopœia*.

The authors of the *Pharmacopœia of India* regard the plant as a simple emollient, and inferior to many others, but recently the root has been found to be of great service in the treatment of gonorrhœa and eczema. In gonorrhœa it is said to stop the muco-purulent discharge, and all the concomitant symptoms, such as heat, scalding and general irritation.

ÆRUA JAVANICA, *Juss.*

Fig.—*Wight Ic.*, *t.* 876.

Hab.—Plains of India. The herb.

ÆRUA LANATA, *Juss.*

Fig.—*Wight Ic.*, *t.* 723; *Rheede, Hort. Mal. x.*, *t.* 29.

Hab.—Plains of India. The herb.

Vernacular.—Chaya (*Hind., Beng.*), Bhui-kallán (*Punj.*), Kumra-pindi, Kapur-madhura, Kapur-phuti (*Mar.*), Pindiconda, Kamiupulai, Nilapulai (*Tel.*), Pulai, Sirru-pulai (*Tam.*).

History, Uses, &c.—These plants are used by the natives of India as diuretics, and are considered to be of great value in lithiasis; they are also thought to be antidotal in cases of poisoning by arsenic. The flowers are sold in the bazars of Northern India under the name of Bhui-kallán. *Æ. lanata* is the Scherubala of Rheede, and Ainslie states that the Vytians consider the root to be demulcent and prescribe a decoction in strangury; in the Concan it is used as a diuretic. *Æ. javanica* has a great reputation in Hyderabad, Deccan, as a remedy for lithiasis, and the flowers have been brought to us for identification by the medical attendant of a gentleman in Bombay, who had been in the habit of obtaining them from Hyderabad under the Marathi name of Kumra-pindi, which is equivalent to the Telingi Pindi-conda, and signifies "cock's *pinda*"; we were informed that much benefit had been derived from their use. These plants resemble *Achyranthes aspera* in their medicinal properties. The flowers are very soft and woolly, and are used for stuffing pillows and mattresses in Sind and in Egypt. In Southern India the natives use the flowering spikes during the Pongul festival for decorating their houses.

Description.—The plants have a white tomentose appearance. The leaves are alternate. The minute flowers are in dense terminal or axillary spikes, those of *Æ. javanica* being much the largest, often 4 to 5 inches in length; they are hermaphrodite, with three concave persistent bracts. The calyx consists of five, nearly equal, erect and hairy sepals; the five stamens are united into a cup at their base; the ovary is one-celled, with a single ovule in each cell. The fruit is a roundish utricle.

CELOSIA ARGENTEA, *Linn.*

Fig.—*Wight Ic., t.* 1767; *Rheede, Hort. Mal. x., t.* 38, 39.

Hab.—Throughout India and tropical Asia. The seeds.

Vernacular.—Sarwáli, Sufèd-murgha (*Hind.*), Svet-murga (*Beng.*), Lápadi (*Guz.*), Kurdu (*Mar.*), Gurugu (*Tel.*), Goraji (*Can.*)

History, Uses, &c.—This common annual plant is considered by some to be the Vitunna of Sanskrit writers; when young and tender it is eaten as a vegetable, but is considered to be very heating. The seeds are considered an efficacious remedy in diarrhœa. Indian Mahometan writers on Materia Medica have adopted Sarwáli as a substitute for the βρεταννικη of Dioscorides, and the Herba Britannica of Pliny, which has been identified by Prof. Muntingius of Groningen as *Rumex Hydrolapathum*, Huds., our Water Dock, the Patience aquatique of the French, and Wasserampfer of the Germans. The author of the *Muffaridat-i-Nasiri* states that 180 grains of the seeds, with an equal quantity of sugar-candy, taken daily in a cup of milk, is a most powerful aphrodisiac.

Dr. Watt (*Dict. Econ. Prod. Ind.*, ii, 240) states, on the authority of the Rev. A. Campbell, that the Santals extract a medicinal oil from the seeds.

Description.—Stem 1 to 3 feet, stout or slender, simple or branched; leaves 1 to 6 inches, narrow; spikes solitary, few or many, 1 to 8 by $\frac{3}{4}$ to 1 inch; peduncle slender; flowers white, tipped with pink, glistening; bracts much shorter than the acute sepals. Seeds lenticular, brown, polished, $\frac{1}{16}$ of an inch in diameter.

Chemical composition.—The following is an analysis of the finely powdered seeds:—

Oil	6·76
Resin, soluble in ether	·81
Alcoholic extract	1·94
Water extract	24·70
Starch, &c.	37·96
Fibre	11·23
Ash	5·80
Moisture	10·80
	100·00

The alcoholic extract contained an alkaloidal principle precipitable by alkalies, soluble in ether, and giving a rose colour with strong sulphuric acid.

CHENOPODIACEÆ.

USHNAN.

GENERA.—**Arthrocnemum, Caroxylon, Salicornia, Salsola, Suæda.** Soda plants.

History, Uses, &c.—Sarjikákshára has doubtless been prepared in India, as it is at the present time, from a very early date. In the time of Pliny a mineral alkali appears to have been prepared in Egypt from the ashes of certain plants and to have been known as Natrum, or in Greek νίτρον (*Plin.* 31, 10), and Strabo, as cited by Beckman, mentions an alkaline water in Armenia used for washing clothes. (*Hist. of Invent.* iii., p. 233.) The plants from which Barilla was prepared were known to the Greeks as τό ἅλιμον or salt-worts. (*Theophr.* H. P. iv., 20; *Diosc.* i., 105.) The Arabs also were early acquainted with the same substance, which seems to have been sometimes potash, or a mixture of soda and potash in various proportions, and to which they gave the name of القلى El-kali or alkali. The Arabian writers describe Ushnán as good for the mange or scab, and the itch; clearing to the complexion, cleansing, emmenagogue and abortive, and a substance with which clothes and the hands are washed. The author of the *Makhzan*, speaking of Ushnán, states that it is a name applied to several plants, one of which has slender branches instead of leaves, upon which knob-like bodies form (*Suæda fruticosa?*). This plant is always fresh and juicy, and is a large herb with round woody stems. He then describes the manner in which the plant is burned in a pit in the ground, and the Kali or Barilla extracted from the ashes. After this he mentions another plant with reddish stems and leaves purplish on one

side and green on the other (*Chenopodium atriplicis ?*), yielding a juice which stains black; this plant he says is very common in Sind and Múltan, and is used for staining the black pattern on the Sind pottery. Lastly, he mentions a plant called Khurú-el-'asáfir (sparrow's dung) with white leaves (*Chenopodium album ?*), and another which is called in Persia Ghásool, and is used for dissolving lac dye, and as a substitute for ink, Dr. Watt, in the *Dictionary of the Economic Products of India,* gives the following list of plants which are used in the manufacture of Sajji-khar or Barilla:—

Arthrocnemum indicum, *Moq.*

Caroxylon fœtidum, *Moq.*

,, **Griffithii,** *Moq.*

Salicornia brachiata, *Roxb.*

Salsola Kali, *Willd.*

Suæda fruticosa, *Forsk.*

,, **indica,** *Moq.*

,, **nudiflora,** *Moq.*

Aitchison states that the name Ishlan (probably a mispronunciation of Ushnán) is applied in the Hari-rud Valley to *Anabasis erispoda,* Benth. et Hook. f., which is used in preparing barilla. In the *Report on Punjab Products,* it is stated that the plants are cut down during the cold months, dried and burnt in a pit of a hemispherical shape, about six feet in circumference and three deep, at the bottom of which one or more inverted earthen pots, having small holes in their bottoms, are sunk. The holes are kept closed at first, but when the alkali begins to run, they are cleared to allow it to fill the pots; when cool it forms a porous mass of a greyish-white colour, consisting of carbonates of soda and potash, sulphate of soda, and organic matter. In native practice this substance is prescribed like our preparations of the caustic alkalies. It is the Sarjikákshára of the Rája Nirghanta and the Sájji of the bazars.

SHUKAI.

Hab.—Persia. The herb.

Vernacular.—Shukai (*Ind. Bazars*).

History, Uses, &c.—This drug is described in Mahometan works as the Akraníkí* or Afsharníkí of the Greeks. Other Arabic names given are Shaukat-el-baida, Shaukat-el-Arabiya, and Kathir-el-rakab. Ibn Sina says it is the same as Bázaward (Bádaward, *Pers.*) Muhammad Husain very truly denies this; he says the Persian names are Charchah and Kangarkhár, and describes two varieties, one with a white flower and more slender stems than the other, which has purple flowers, and is the kind generally used. The latter, he says, has triangular stems, the size of a man's finger or less, and thick, small, triangular, downy leaves terminating in thorns; the seeds are small, triangular, and of a greyish colour. The whole drug is of a yellowish white colour and sweetish taste. The plant and fruit are generally used, but the root is to be preferred. Shukai is more drying and astringent than Bádaward; it is attenuant and deobstruent, &c., &c. (*Makhzan-el-Adwiya*, article *Shukai*) Haji Zein-el-Attar states that it is useful in palsy and other diseases caused by cold humors. He quotes Galen as recommending its use in melancholia, and Paulus as saying that it is useful in leprosy. In Persia it is said to have a reputation as a remedy for ague. The dose is from 2 to 5 dirhams.

Description.—The drug as met with in India consists of all parts of the plant broken up, but very little of the root is present. The portions of the stem are of a greenish-yellow colour, round, crooked, channelled, with numerous branches springing from the axils of the leaves; the external surface of the stem is siliceous, hard, and pubescent; internally it is full of soft pith. The petioles of the leaves are stem-clasping, the lower ones completely so. The lower leaves are of considerable

* Possibly from ἀκρώνυχος, on account of its thick leaves, each lobe of which terminates in a thorn.

size with a triangular midrib, channelled on the upper surface, and short, thick, spinous lobes which vary much in shape. The plant has a gummy, rather disagreeable taste. The fruit is occasionally found mixed with the drug in considerable quantity. It is a woody nut, ¼ of an inch long, formed by the fusing together of the different parts of the perianth and ovary, somewhat triangular in form; at the base are spines formed by the calycine segments; at the apex the perianth forms a number of tooth-like processes which surround the top of the ovary. The seed is ovoid, horny, and has a terebinthinate odour.

Chemical composition.—The chopped plant, air-dried, was treated for several days with warm 80 per cent. spirit, the resulting tincture distilled to remove alcohol, and the residue finally deprived of the last traces of alcohol by spontaneous evaporation. The extract was then mixed with water acidulated with sulphuric acid and agitated with petroleum ether. The petroleum ether extract was greenish, soft, with a camphoraceous and peppermint odour and taste. Treated with warm proof spirit a portion dissolved, forming a clear yellowish liquid while warm, but from which resinoid matter separated on cooling. The solution had a strongly acid reaction and gave a greenish coloration with ferric chloride. After the addition of sulphuric acid, it afforded a very marked precipitate with Mayer's and other alkaloidal reagents. With alkalies the solution was coloured of a bright yellow hue; basic acetate of lead gave a bright yellow precipitate, a similar precipitate, but smaller in amount, being also afforded by lead acetate. The soft resinous residue insoluble in proof spirit, after standing deposited a small amount of bright yellow matter which was destitute of crystalline structure on microscopic examination. In ammonia the residue was insoluble.

During agitation of the extract with petroleum ether a considerable amount of dark, soft resin separated; this resin had a marked peppermint odour, and was only partly soluble in ether. After repeated washing with ether, it was left as a dark, soft mass which could be kneaded by the fingers; on drying at 100°C. a nearly black brittle mass was left, easily pulverised

and forming a dark olive-brown coloured powder, odourless and tasteless, but bitter in an alcoholic solution, soluble in ammonia, forming a deep yellowish brown solution, from which it was reprecipitated by acids in dirty yellowish white flocks. In alcohol the resin was easily soluble with acid reaction; with ferric chloride the alcoholic solution was slightly darkened in tint.

After agitation with petroleum ether the acid aqueous solution was agitated with ether: the ether extract was small in quantity, and though some small points separated on the sides of the dish which appeared crystalline on naked-eye inspection, on microscopic examination no crystalline forms were visible. In water the extract was partly soluble with strong acid reaction: the aqueous solution gave with ferric chloride a dirty bluish-green precipitate, changing almost instantly to dirty whitish-brown. With alkalies a bright yellow coloration was afforded; the solution did not precipitate gelatine and gave no reaction with cyanide of potassium. The ether extract was treated with ammonia, in which, with the exception of some flocks, it appeared to be wholly soluble. The solution exhibited a marked greenish fluorescence; it was agitated with ether. The ether extractive formed a non-crystalline yellow varnish, soluble in alcohol without fluorescence, with a very bitter taste and neutral reaction; treated with dilute sulphuric acid a small portion dissolved, and the solution afforded marked reactions with all alkaloidal reagents. The alkaline aqueous solution was acidulated, which caused whitish flocks to separate, and agitated with ether. The ether extract was a non-crystalline yellow varnish, partly soluble in water with strong acid reaction, the solution affording similar reactions to the original aqueous solution of the ether extract. The ammoniacal solution exhibited a greenish fluorescence.

The original aqueous acid solution was now rendered alkaline and reagitated with ether; a yellow varnish was obtained after spontaneous evaporation of the ether. The extract was treated with dilute sulphuric acid and agitated with ether, the ether separated, the aqueous solution rendered alkaline, and again agitated with ether, in order to purify any alkaloidal principle

which might be present. The purified ether extract dried to a yellow varnish; the solution in sulphuric acid gave a very marked yellowish precipitate with Mayer's reagent; a white precipitate with alkalies; with Fröhde's reagent, a precipitate first yellowish, rapidly changing to pale blue, and darkening, on standing or warming, to deep prussian blue; chromate of potash gave a yellow precipitate; bichromate of potash and concentrated sulphuric acid, a dirty orange-red; ferric chloride no reaction; the solution was destitute of any bitter taste. Considerable loss of alkaloid occurred during its purification, as the sulphate was somewhat soluble in ether.

Finally the original alkaline aqueous solution was acidulated with sulphuric acid, and agitated with amylic alcohol. On evaporating off the amylic alcohol, a deep orange-red varnish was left, partly soluble in water with strong acid reaction, the solution giving an olive-brown coloration with ferric chloride; no precipitate with gelatine; a bright yellow coloration with alkalies; a bright yellow precipitate with basic acetate of lead; and it reduced Fehling's solution on boiling. The residue, insoluble in water, was dissolved by ammonia, forming a deep orange-yellow solution from which acids afforded a whitish precipitate, the yellow colour being destroyed.

SPINACIA OLERACEA, *Linn.*

Fig.—*Lamk. Encycl., t.* 814; *Wight Ic., t.* 818. Spinach (*Eng.*), Epinard (*Fr.*). Syn. *S. tetrandra*, Stev.

Hab.—Persia. Cultivated in India. The herb and fruit.

Vernacular.—Pálak (*Hind.*), Pálang (*Beng.*), Vusayley-keeray (*Tam.*).

History, Uses, &c.—This potherb is a native of Persia; it is described in the Persian *Burhán* under the name of اسپناخ (ispanákh) as a potherb much used in broth. The name is now often incorrectly pronounced *Ispanáj* by the Persians, and *Isfanáj* or *Isfánáj* by the Arabs. The plant has been introduced into India by the Mahometans, and is now cultivated in many

parts of the country. The African Moors brought it to Spain, whence its use gradually spread to other parts of Europe. It was known in England as *Spinach* in 1568, and is noticed in *Turner's Herbal,* published in that year, as "lately introduced and not much in use." Aitchison, in his *Botany of the Afghan Delimitation Commission,* remarks that it grows profusely in the vicinity of Simkoh in the Badghis, and is collected as a potherb by the natives. He says:—"I have no doubt Mr. De Candolle is correct in assuming *S. tetrandra* to be the wild form of *S. oleracea.*" Spinach is much valued by the Mahometans on account of its cooling and emollient properties, and the seeds are sold in all the Indian bazars. A decoction of the plant is prescribed in febrile affections, in lithiasis, and in inflammation of the lungs or bowels. The juice of the leaves is also used as a diuretic and as a gargle in sore-throat. Poultices of the leaves or boiled seeds are applied to soften tumours and promote the maturation of boils. The herb is considered one of the most digestible and wholesome of vegetables.

Description.—The plant has large, thick, succulent, deep-green leaves, of a somewhat triangular form, produced on long foot stalks. The stem is erect, large, round and hollow, about two feet high. The male plants are distinguished by their long terminal spikes of green flowers, while those of the females are axillary, sessile and clustered. The fruit is prickly in some varieties and smooth in others.

Chemical composition.—Besides a large quantity of mucilage spinach contains so large a proportion of nitrates, that the water in which it has been boiled may be used for making touch-paper. The following figures give the mean percentage composition of three samples of spinach recorded by König:—

Water	88·47
Nitrogenous matter	3·49
Fat	0·58
Sugar	0·10
Nitrogen-free extractive	4·34
Fibre	0·93
Ash	2·09

Anhydrous spinach contained, as the mean of three analyses of different samples,—

Nitrogen	4·94
Carbohydrates	37·93

Basella alba, *Linn., Wight Ic., t.* 896, is known ~~as Indian~~ spinach, or Malabar Nightshade, and the juice of the leaves, which is demulcent and cooling, is a popular application to allay the heat and itching of urticaria arising from dyspepsia, an affection which the Hindus consider to be indicative of bile in the blood. The boiled leaves are also used as a poultice. This herb is extensively cultivated as a vegetable, and bears the vernacular names of Poi (*Hind.*), Mayál (*Mar.*), Vasala (*Tam.*), Bachchali (*Tel.*), and Bili-basale (*Can.*). The generic name is derived from the Tamil. The Sanskrit name is Potaki or Upodika.

Many plants of this order are used as potherbs in the East. In Persia and Biluchistan, **Chenopodium Botrys,** *Linn.*, **C. Blitum,** *Hook. f.*, and **Atriplex Moneta,** *Bunge*, are much used. On the Indian coasts, **Arthocnemum indicum,** *Moq.*, a plant of the salt marshes, is used as a vegetable, and is also pickled. Fryer, who visited Bombay in 1694, calls it "samphire."

Plants more generally known as vegetables are **Chenopodium album,** *Linn.*, **C. ambrosioides,** *Linn.*, **Beta vulgaris,** *Linn.*, and **Atriplex hortensis,** *Linn.* The seeds of the Beet are sold in Indian Bazars for medicinal use, under the name of Chukandar.

POLYGONACEÆ.

POLYGONUM AVICULARE, *Linn.*

Fig.—*Eng. Bot.*, 1252. Knot-grass (*Eng.*), Renouée des oiseaux (*Fr.*).

Hab.—Northern Asia, Europe. Introduced into India. The root and seeds.

Vernacular.—Machoti, Bijband, Kesri (*Hind.*), Endráni (*Sind.*)

History, Uses, &c.—This plant is identified by Fée with the male πολύγονον of Dioscorides, a vulnerary and astringent herb, the Polygonos of Pliny (27, 91). It was used by the ancients to arrest hemorrhage, the seeds were considered to be laxative and diuretic and to arrest defluxions. For burning pains in the stomach the leaves were applied topically, and were used in the form of a liniment for pains in the bladder and for erysipelas. The juice was administered in fevers, tertian and quartan more particularly, in doses of two cyathi, just before the paroxysms. Scribonius (*Comp.* 46) says that it received its name "polygonos" from its being found everywhere. Ibn Sina and other Arabian physicians call the plant A'sa'r-ra'i (عصا الراعی) and Batbát (بطباط); they consider it to be cold and dry, and reproduce what the Greeks have said concerning its medicinal uses. The Persians call it Hazàr-bandak. It is the *Polygonum mas* of Matthiolus (*Valgr.* ii., 300).

In India the plant is still used by the Hakims in the diseases named by Dioscorides.

In our own times Polygonum root has been used as a febrifuge in Algeria, and has been reported upon as being an excellent remedy for chronic diarrhœa and stone in the bladder. Its value has apparently been much exaggerated. (*J. R. Jackson, Amer. Journ. Pharm.*, 1873, 247.)

In the *Lancet* (1885, 658) it is said to be used in Russia, under the name of *Homeriana,* as a popular remedy in lung affections. Dr. Rotschinin, who has experimented with the drug, found it really valuable in several cases of bronchitis, two of which were capillary; also in three cases of whooping cough. It was tried in phthisis, but no definitely satisfactory results were obtained. A tumblerful of the decoction was given three times a day.

Description.—Root fibrous, long, very tough, and somewhat woody; branched below, simple at the crown. Stems several, spreading in every direction, generally prostrate, much

branched, round, striated, leafy at the numerous knots or joints. Leaves alternate, stalked, hardly an inch long, elliptic or lanceolate, entire, obtuse, single-ribbed, smooth except at the margin, tapering at the base, very variable in width, substance rather coriaceous, colour greyish or glaucous. Flowers variegated with white, crimson and green. Seeds acutely triangular, of a shining black.

Polygonum Bistorta, *Linn.*, is the *Anjubár* of the Western Arabs, and their description of it is still reproduced in Indian medical works. **P. viviparum,** *Linn.*, a nearly allied species, is used as a substitute for it in the Punjab, under the same Arabic name, and is called in the vernacular Maslun and Bilauri. The **Anjubar-i-Rumi** of the bazars, imported from Persia, is a thick reddish-brown astringent root-bark, evidently obtained from a tree or shrub of some size, and it may be observed that Aitchison found an arboreous species of Polygonum growing in the Badghis and Paropamisus.

Other species of Polygonum which have been used medicinally, and which occur in India, are:—

P. glabrum, *Willd.*, **P. Hydropiper,** *Linn.*, **P. molle,** *Don.*, **P. barbatum,** *Linn.*, and **P. alatum,** *Ham.* All these plants are astringent, but *P. Hydropiper* also contains a pungent volatile principle having acrid properties.

Chemical composition.—Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, Nov. 1879) separated from *P. Hydropiper* a crystalline principle which he named *Polygonic acid.* H. Trimble and H. J. Schuchard (*Amer. Journ. Pharm.*, Jan. 1885) re-examined the plant with the following results:—They found that the peculiar pungent principle, although present in a weak alcoholic tincture, disappeared on distillation, the pungent taste of the herb being absent both from the distillate and the residue in the retort.

From these experiments they conclude that the active principle is decomposed on the slightest heating, and that the only

proper preparation of the drug would be one made without the application of heat. They prepared the polygonic acid of Dr. Rademaker, and conclude from their experiments that it is only a mixture of impure tannic and gallic acids.

The following summary shows the amount of the most important constituents :—

	Per cent.	
Water	10·25	
Wax	2·70	From petroleum spirit solution.
Resin and chlorophyll	1·54	From ether solution.
Resin, tannin, and chlorophyll.	5·14	From alcoholic solution.
Sugar	1·44	From aqueous solution.
Gum	·55	
Tannin and extractive	5·23	
Albuminoids	1·00	From alkaline solution.
Phlohaphene, &c.	5·95	
Salts and a small amount of extractive	6·00	From dilute acid solution.
Cellulose	57·45	
	97·25	

Separately determined: tannin, 3·46 per cent.; ash, 7·40 per cent. (*Year-Book of Pharm.*, 1885, p. 160.)

Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, June 1886) re-asserted the existence in this plant of the active crystalline principle, described by him as polygonic acid, and supplied further details respecting its extraction and properties, together with a wood-cut illustration of its crystals. He says:—"Polygonic acid may be prepared by treating the plant with water, to which some bicarbonate of sodium has been added, and allowing it to macerate for 24 hours; or by precipitating

a fluid extract with basic acetate of lead. In each case separate the base by means of sulphuric acid, and the organic acid by means of ether. Allow the ethereal solution to evaporate, and treat the residue with distilled water, and filter; this separates the resin (resinous acid). The filtrate is then filtered through animal charcoal repeatedly, until all colouring matter is removed. The filtrate is next treated with solution of gelatine, in order to remove any tannic acid that might be present, again filtered, and evaporated to dryness, redissolved in ether, and the ethereal solution allowed to evaporate spontaneously. Polygonic acid thus prepared crystallizes in needles. Its solution in water does not precipitate gelatine nor produce a bluish-green coloration when added to a mixture of ferrous and ferric salts in solution, showing absence both of gallic and tannic acids. It is freely soluble in water, less so in ether, and insoluble in petroleum spirit. The heat of a water-bath does not destroy any of its properties. (*Year-Book of Pharm.*, 1886, p. 210.)

The other species of Polygonum which have been examined contain starch and tannic and gallic acids. Bowman (1869) obtained 21 per cent. of tannic acid from Bistort root. In the Bengal Chemical Examiner's Report for 1884 we meet with the following notice of *P. glabrum*: "Several specimens of a plant called *Bish-kurki* were sent from Cachar for examination. It was stated that the plant was frequently added to country spirit, which it was believed might have thus communicated to it some specially noxious property. The plant was identified by Dr. G. King as *Polygonum glabrum,* and on chemical examination and physiological application was not found to possess toxic properties."

RHEUM OFFICINALE, *Baillon.*

Fig.—*Bentl. and Trim., t.* 213. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

RHEUM PALMATUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 214. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

Vernacular.—Rewand-chini, Lakri-rewand-chini (*Ind. Bazars*).

History, Uses, &c.—The Chinese appear to have been acquainted with the properties of rhubarb from a period long anterior to the Christian era, for the drug is treated of in the herbal called *Pen-king*, which is attributed to the Emperor Shen-nung, the father of Chinese agriculture and medicine, who reigned about 2700 B.C. The drug is named there *Huang-hâng*, yellow, excellent, and *Ta-huang*, the great yellow. The latter name also occurs in the great Geography of China, where it is stated that rhubarb was a tribute of the province Si-ning-fu, eastward of Lake Kuku Nor, from about the 7th to the 10th centuries of our era.

As regards Western Asia and Europe, we find a root called ῥᾶ or ῥῆον, mentioned by Dioscorides as brought from beyond the Bosphorus. Pliny describes a root termed *Rhacoma*, which, when pounded, yielded a colour like that of wine, but inclining to saffron, and was brought from beyond Pontus. The drug thus described is usually regarded as rhubarb, or at least as the root of some species of Rheum. Lassen has shown that trading caravans from Shensi in Northern China arrived at Bokhara as early as the year 114 B.C. (*Pharmacographia.*)

Riwâs (the plant Ri in the Zend language) was known to the ancient Persians, and the same name is still applied to a species of Rheum in the province of Gilán in Persia. Aitchison found *R. Ribes*, Gronov., on the Paropamisus range, to be known to the peasantry as Rewash, Rewand and Chukri; he states that the flowering branches are eaten, and the root used in colouring leather. In the Hari-rud Valley he found *R. tataricum*, Linn., f., to be known as Rewash-i-dewána, "fools' rhubarb," the fruit and root being used as a purgative. Ibn Sina (978)

notices both the plant Ribás (Riwás, *Pers.*) and the drug Ráwand (Rewand, *Pers.*)—the first an acid plant, and the second evidently Chinese rhubarb. Mesue, early in the 11th century, distinguishes between Chinese and Khorasan rhubarb, and Haji Zein-el-attár, writing in 1368, says:—"I consider Rewand to be the same as Ribás. Ibn Jazla, the author of the *Minháj*, states that there are two kinds, China and Khorasan rhubarb, and that the latter is known as Ráwand-el-dawább, and is used in veterinary practice, whilst the Chinese is reserved for human beings. The latter is the best kind, and, when powdered, is of a saffron colour; the fractured surface has the grain of a cow's hump, and is friable; it is called Rewand-i-lahmi (meaty rhubarb), and should be in large pieces like a horse's hoof, and not worm-eaten. In my experience there are three kinds of rhubarb—Chinese, Khorasan, and Indian. Masih (Mesue) states that rhubarb is hot in the third degree and dry in the first." (*Ikhtiárát*, article *Ráwand.*)

The author of the *Makhzan-el-Adwiya*, himself a native of Khorasan, has the following account of Ribás:—"It is called in Persian Riwás, Riwáj and Chukri, and is an herbaceous plant a cubit in height; from the centre spring one or two flattened stems, 2 fingers by 1 finger in thickness, having a pubescent bark, the lower portion of which is purplish and the upper green, like the stem of a lettuce. Internally the stem is white, soft and juicy; it has a sour and somewhat astringent taste. The top of the stem is branched, and between the branches are green rough bracts; the flowers are red, and have a slightly acid and sweetish taste. The plant grows in the cold snowy mountains; the best is the Persian, white, delicate, succulent and subacid, with a stout tall stalk. The root of this plant is rhubarb (Ráwand), which has already been described, and it is called 'Ribás-i-Mu'ammiri,' because one Mu'ammir of Nishapur was the first to discover this." For the history of rhuharb in Europe, the reader is referred to the *Pharmacographia.*

Rhubarb is not an article of the Hindu Materia Medica, but the modern Hindus have become acquainted with its properties through Mahometan and European physicians.

In the use of rhubarb as a medicine, the Mahometans quote and follow Galen, Oribasius, Paulus, Rází, Ibn Sina and Masih, whose opinions it is unnecessary to reproduce. In India it is chiefly used as a stomachic, tonic, and mild aperient.

The rhubarb found in the Indian bazars is of a very inferior kind, in long stick-like pieces, shipped to Calcutta and Bombay from the Eastern ports. It comes from China, and has hardly any aroma, a bitterish taste, and but slight purgative action. When fresh, it is covered with a yellow dust, like ordinary rhubarb. The natives use it as a tonic and stomachic. None of the commercial rhubarb known as East Indian is imported into Bombay unless specially ordered from China, but it often passes through the port on board the P. and O. Company's steamers. Bombay druggists, Native and European, usually obtain their rhubarb from London. On account of its low price, the former always import English rhubarb. In the *Pharmacopœia of India*, the bazar rhubarb of India is attributed to *Rheum emodi*, *R. Moorcroftianum*, and *R. Webbianum*, all Himalayan species; it is said to be of two kinds, large and small: "The first in cylindrical pieces, of various sizes and shapes, furrowed; cut obliquely at the extremities, about four inches long and an inch and a half in diameter; of a dark-brown colour, feeble rhubarb odour and bitter astringent taste; texture radiated, rather spongy, not presenting on fracture the marbled texture characteristic of ordinary rhubarb; pulverized with difficulty; powder of a dull brownish-yellow colour. The second consists of short transverse segments of the root branches; of a dark-brownish colour, odourless or nearly so, with a very bitter astringent taste." (*Op. cit.*, p. 187.) The first kind so exactly corresponds with the stick rhubarb imported from China, that we are of opinion that it was not Himalayan rhubarb, whilst the second probably was of Indian origin. Trials made with Himalayan rhubarb by Prof. Royle (*Calcutta Med. and Phys. Trans.*, iii., p. 439) and Mr. Twining (*Diseases of Bengal*, i., p. 220) are reported to have been satisfactory, and Dr. Hugh Cleghorn (*Madras Quart. Med. Journ.*, 1862, v., p. 464), who furnishes some interesting remarks on

Himalayan rhubarb, states that it is only an inferior variety that reaches the plains of Hindustan. He tested the action of the fresh root, and found it to resemble the action of Russian rhubarb. (*Op. cit.*, p. 188.)

Description.—China rhubarb consists of portions of a massive root which display considerable diversity of form, arising from the various operations of paring, slicing and trimming to which they have been subjected. Thus some pieces are cylindrical or rather barrel-shaped, others conical, while a large proportion are plano-convex, and others again are of no regular shape. These forms are not all found in the same package, the drug being usually sorted into *round* and *flat rhubarb*. The pieces are from 3 to 4 inches long by 2 to 3 inches in breadth. Many pieces are pierced with a hole. The drug is dusted over with a bright brownish-yellow powder, on removal of which the surface is seen to have a rusty-brown hue. The character which most readily distinguishes the rhubarb of China is that well-developed pieces, broken transversely, display dark lines arranged as an internal ring of star-like spots. In good rhubarb the interior is compact and veined with reddish-brown and white, sometimes mixed with iron-grey. The root when chewed tastes gritty, by reason of the crystals it contains of oxalate of calcium; but it is, besides, bitter, astringent and nauseous. The odour is peculiar. (*Pharmacographia.*) The characters of the *Chinese stick rhubarb* which is used in India have already been noticed; it would appear to consist of the smaller branches of the root which have been removed in preparing the drug for European commerce.

Chemical composition.—The purgative principle of rhubarb is *Cathartic acid*, a glucoside discovered by Kubly (*Bull. Soc. Chim. Paris*, 1866) in Senna in combination with calcium and magnesium, and now known to be present in many other purgative drugs. Rhubarb also contains *Chrysophanic acid*, $C^{15}H^{10}O^{4}$, and an allied substance *Emodin*, $C^{15}H^{10}O^{5}$; a tannin, $C^{26}H^{26}O^{14}$, named Rheo-tannic acid by Kubly; resins and mucilaginous matters. Small quantities of albuminoid substances, malic acid, fat and

sugar have also been met with in rhubarb. The amount of the mineral constituents is exceedingly variable: Flückiger and Hanbury obtained from two good samples of China Rhubarb, dried at 100°C. and incinerated, 12·9 and 13·87 per cent. of ash; another pale sample yielded no less than 43·27 per cent. The ash consists of carbonates of calcium and potassium.

The following analyses by Elborne show the percentage composition of three samples of English Rhubarb and two of the Eastern drug:—

	R. officinale, ordinary cultivation.	R. officinale, high cultivation.	R. rhaponticum.	East Indian Rhubarb.	Russian Rhubarb.
Moisture	6·06	7·9	5·57	5·4	12·6
Ash	9·33	4·9	7·9	9·28	6·63
Mucilage (soluble in water)	6·5	4·8	4·1	4·0	5·5
Cathartic acid	3·5	3·2	3·3	4·5	3·2
Tannin and chrysophan	14·3	11·7	12·5	11·7	11·0
Organic acid	3·3	2·2	1·5	3·0	4·5
Resinous substances soluble in alcohol	2·6	2·0	3·4	4·6	5·2
Fat and free chrysophanic acid soluble in petroleum ether	0·4	0·3	0·2	0·7	1·5

Rumex vesicarius, *Linn., Campd. Rum.*, 129, *t.* 3, *f.* 1. 8; Chúka (*Hind., Beng., Bomb.*), Chúkra (*Sans.*), is cultivated all over Asia, and is used just as sorrel is in Europe; excellent 'potage à l'oseille' may be made with it The plant is, doubtless, one of the kinds of Hamáz (Dock) mentioned in Arabic works, and is much esteemed for its medicinal properties. The juice is said to allay the pain of toothache, and by its astringent properties to check nausea, promote the appetite, and allay morbid craving for unwholesome substances. The herb also is considered very cooling and of use in heat of stomach, and externally as an epithem to allay pain, especially that caused by the bites or stings of reptiles and insects. The seeds are said to have similar properties, and are prescribed roasted in dysentery, and as an antidote to scorpion stings. The root is also medicinal.

Description.—The fruit sold in the shops as Gulhamáz (Dock flowers) is reddish-brown, about $\frac{1}{10}$ of an inch long, and consists of three fringed, leaf-like expansions, each furnished with an oblong glandular body and attached at the base to a short thick pedicel; they enclose a triangular, polished, dark-brown seed.

Bijband.—Shining angular seeds (nuts), evidently derived from a species of Rumex. They are used as an aphrodisiac. Murray states that the fruit of *Polygonum aviculare*, Linn., is known as Bijband or Endraní in Sind. According to Atkinson, *Rumex Wallichii*, Meissn., referred by Hooker to *R. maritimus*, Linn., yields the Bijband of the bazars. Probably the seeds of several species are collected.

Rumex Patientia, which Hooker thinks, along with *R. aquaticus*, Linn., might be united with *R. orientalis*, Bernh., has been examined by W. Dahlen, who gives the following percentage composition:—Water, 92·18; Nitrogenous matter, 2·42; Oil, 0·48; Sugar, 0·37; Nitrogen-free extractive, 3·06; Fibre, 0·66; Ash, 0·82.

This plant is a native of the Western Himalaya and extends westward to Asia Minor, Syria and Greece; it was named by Hayne *R. Dioscoridis* (*Arnzeik.* xiii., 5, *t.* 5), from its having been identified with the λαπάθον of the ancients, and it is still called λαπαθο in Greece.

ARISTOLOCHIACEÆ.

ARISTOLOCHIA INDICA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1858; *Griff. Ic. Pl. Asiat.*, *t.* 529; *Rheede, Hort. Mal. viii.*, *t.* 25. Indian Birthwort (*Eng.*).

Hab.—Throughout the low country of India. The stem and root.

Vernacular.—Isharmúl, Rudrajata (*Hind.*), Ishormúl (*Beng.*), Sápsand, Ishvari, Rudrajaṭa (*Mar.*), Sápsan, Ishwari (*Guz.*),

Ichchura-mula, Peru-marindu (*Tam.*), Ishvara-veru, Govila (*Tel.*), Ishvari-beru, Nanjin-beru (*Can.*), Karalvekam, Ishvara-muri (*Mal.*), Sápús (*Goa*).

History, Uses, &c.—This scandent shrub is the Rudra-jata of the Rája Nirghanta; other Sanskrit names for it are Arkamúla, "lightning root"; Ishvari, "goddess"; Sunanda, "pleasing"; and Sudhy-upásya, "worthy of worship." It is considered to be attenuant, deobstruent, emmenagogue, antarthritic, and a valuable medicine in the bowel affections of children who are teething. In the Mahometan Materia Medica it is known as Zarawand-i-Hindí, and is admitted as an Indian substitute for Zarawand (*Aristolochia longa*). The early Portuguese settlers in India gave it the name of Raiz de Cobra, on account of its supposed efficacy against the bite of that snake.

The plant was first described by Rheede, who compares its odour to that of fresh ginger, and states that boiled in oil it is applied as a liniment to snake-bites, and a decoction given internally. It is also administered, rubbed to a paste with water or in decoction, in cold fevers, headache, flatulent distention, and dysuria. As a lotion it relieves gouty pains, and the powder with pepper and hot water stops bloody fluxes.

It appears to be the *Radix puloronica* of Rumphius, which is employed in Banda in decoction, in diseases of the intestines, and also in intermittent fevers. Ainslie (*Mat. Ind.*, ii., 298) notices its use by the Tamil doctors in the bowel complaints to which children are subject in consequence of indigestion and teething, and says they sometimes call the drug *Talashroolivayr.* He also says that the powder is taken internally in cases of snake-bites and applied to the bitten part. Loureiro (*Flor. Cochin-Chin.*, vol. ii., p. 528), speaking of the plant, says: "Prodest in colica, cibi inappetentia, febribus intermittentibus, obstructionibus, hydrope." Fleming (*Catalogue of Indian Plants*, p. 8) notices its use in Upper India as an emmenagogue and antarthritic.

The plant is placed in the secondary list of the *Pharmacopœia of India*, but no further information with regard to its medicinal

prop erties is given. In Bombay Sápsan is chiefly prescribed in the bowel complaints of children and in cholera; it is regarded as a stimulant tonic, and is also applied externally to the abdomen. Babu T. N. Mukharji states that the juice of the fresh leaves is very useful in the croup of children, by inducing vomiting, without causing any depression. (*Amsterdam Cat.*, p. 21.)

Description.—The drug as sold in the shops consists of the root and stem, the latter in by far the larger proportion; in many parcels the stem only is to be found. It is either in short pieces, or the whole stem may be twisted into a kind of circular bundle. The thickest portion of the stem is ¼ to ½ an inch or more in diameter, and has a central woody column made up of about ten wedge-shaped portions. The bark is thick and corky, marked with longitudinal ridges and numerous small warty projections; it is of a yellowish-brown colour. The taste is bitter and camphoraceous, and the odour aromatic and agreeable.

Microscopic structure.—The wedge-shaped woody columns are traversed by large vessels, the medullary rays are distinct and easily traced into the bark; in the latter, which consists of starchy and corky parenchymatous tissue, there is a circular zone of large yellow stone-cells.

Chemical composition.—The air-dried roots were contused and digested for several days with warm 80 per cent. alcohol. The greater part of the alcohol from the resultant tincture was removed by distillation, but the last traces could be separated by spontaneous evaporation with difficulty, owing to soft resinous matter separating and floating on the surface and thus preventing evaporation. The extract still containing alcohol, and which possessed a strong smell of the drug, was mixed with water and agitated with light petroleum ether. During agitation a dark viscid resinous mass separated, as well as a small amount of a bright yellow powder. The clear aqueous solution, after separation of the petroleum ether, was gently heated to expel alcohol, and the residue acidified with sulphuric acid and agitated with ether. After separation of the ether, the aqueous

solution was rendered alkaline and reagitated first with ether, then with chloroform, and lastly with amylic alcohol.

The dark resinous matter which separated on agitation with petroleum ether was repeatedly shaken with ether, in which a portion was soluble. The ethereal extract was of the consistence of honey, had a taste and smell like that of a mixture of turpentine and peppermint, and was also bitter: in alcohol it was soluble with acid reaction; it was dissolved by ammonia, forming a dark reddish orange-coloured solution, and was reprecipitated by acids in yellowish flocks. The residue insoluble in ether was soft when moist and dark chocolate in colour: on drying at 100°C. it became brittle, and could be easily reduced by pressure between the fingers to a yellowish powder which possessed neither taste nor odour: in alcohol it was soluble with acid reaction: in ammonia the greater part dissolved, and was reprecipitated in yellow flocks by acids. The bright yellow powder was soluble in ether, and was left on spontaneous evaporation as a bright yellow varnish, destitute of crystalline structure. In warm water the greater part dissolved, forming a pale yellow solution which became turbid on cooling and which had a marked acid reaction. In alkalies it was soluble with deep orange coloration, and was reprecipitated by acids in pale yellow flocks: with ferric chloride it gave a dirty brownish-red precipitate: with basic acetate of lead, yellowish flocks: with baryta water no precipitate, only a deep yellow coloration.

The light petroleum ether extract was soft and brownish in colour, and had a strong odour of turpentine; on gently heating in a small retort, a trace of a distillate was obtained which had a most powerful terebinthinate odour and taste.

The extract obtained by agitating the original aqueous acid solution with ether was a bright yellow, transparent, soft, varnish-like mass, from which slowly separated a few small yellowish nodules, which, on microscopic examination, were found to consist of bundles of rod-shaped crystals. The extract was soluble in alcohol with strong acid reaction, the solution exhibiting a well-marked greenish fluorescence, as did also an ethereal solution.

The taste was very bitter, aromatic, and also somewhat terebinthinate. On treatment with ammonia the extract was partly dissolved, yielding a deep orange-red solution, which was agitated with ether, the ether showing a marked greenish fluorescence. On evaporating off the ether, a bright yellow, viscid, transparent extract was left, with a bitterish taste, accompanied by a strong one of turpentine. In alcoholic solution the extract was neutral in reaction, the solution exhibiting a marked fluorescence. The ammoniacal solution, after separation of the ether, was acidulated with sulphuric acid and reagitated with ether. On evaporation of the ether, a bright yellow, soft, varnish-like residue was left; on heating with water the greater part dissolved, forming a clear solution which became turbid on cooling. With alkalies the extract gave a deep orange-red solution: with ferric chloride a dirty brownish-red precipitate: with basic lead acetate yellowish flocks were precipitated: with lime and baryta water a yellowish coloration, but no precipitates. After boiling with dilute sulphuric acid, Fehling's solution was reduced. The reactions of this acid were, therefore, similar to those of the *yellow powder* which separated on agitation with petroleum ether.

The original solution after addition of sulphuric acid was rendered alkaline with ammonia and agitated with ether. On spontaneous evaporation of the ether, a yellow, soft, non-crystalline, transparent, varnish-like extract was left. This was treated with a little dilute sulphuric acid, in which a portion only dissolved, and agitated with ether, which removed resinous matter. The ether was then separated, and the aqueous solution rendered alkaline, and reagitated with ether. A yellow non-crystalline extract was obtained, which was nearly wholly soluble in dilute sulphuric acid, and which afforded the following reactions : with ammonia a white precipitate soluble in excess : with caustic soda a similar precipitate, only slightly soluble in excess: with platinic and auric chlorides yellow precipitates: marked yellow precipitate with Mayer's reagent, and with other alkaloidal reagents: with strong nitric acid a yellowish coloration: with Fröhde's reagent a deep-blue coloration in the cold, no alteration in tint on gently heating. After boiling with

dilute sulphuric acid, the liquid slightly reduced Fehling's solution.

After agitation with ether, the liquid was agitated with chloroform, which separated an alkaloidal principle mixed with much colouring matter. The reactions were similar to those yielded by the principle extracted by ether.

Finally the liquid was agitated with amylic alcohol, the alcohol exhibiting very marked greenish fluorescence. The amylic alcohol extract contained a large amount of resinous matter insoluble in dilute sulphuric acid ; the acid solution afforded, however, very marked evidence of the presence of a principle reacting with alkaloidal reagents, the colour reactions being similar to those yielded by the principle separated by ether and chloroform. It would be premature for us to definitely state that the principles extracted by ether, chloroform, and amylic alcohol were either identical or different.

Toxicology.—Dr. S. M. Shircore of Moorshedabad states that it is undoubtedly used to procure abortion.

Commerce.—The drug can hardly be called an article of commerce, as it is supplied to the shops by herbalists or country people. It is very abundant in the Southern Concan. Value, annas 6 per pound.

ARISTOLOCHIA BRACTEATA, *Retz.*

Hab.—Deccan Peninsula to Bandelkand, Sind, Ceylon. The herb.

Vernacular.—Kiramár, Gandháni (*Hind.*), Kiramár (*Guz.*), Gandhán-gavat, Gándháni (*Mar.*), Ganajali-hullu, Kattagiri (*Can.*), Adutina-pálai (*Tam.*), Gádide-gadapara-áku, Kadapara (*Tel.*), Átutinta-pála (*Mal.*).

History, Uses, &c.—This plant is the Dhúmra-pattra of the Rája Nirghanta, *i.e.*, the plant with grey leaves. The synonyms are:—Dhúmráhva, Su-labhá, Svayam-bhuva, Gridhra pattra, Gridhráni, Krimi-ghni, Srima-lápaha. It is much used

by Hindu physicians on account of its bitter, purgative, and anthelmintic properties. The leaves are applied to the navel to move the bowels of children, and are also given internally in combination with castor oil as a remedy for colic. The juice of the fresh leaves or the powder of the dried leaves is a favourite application to sores to destroy maggots. In the Kurnool District, when the *sazza* is attacked with insects, a long rope soaked in the juice of the plant, and with the leaves of the plant attached, is drawn over the crop. Dr. Hové, who visited Bombay in 1787, found the plant growing in great abundance in Guzerat. He states that the root and leaf are remarkably bitter, and yield a thick yellowish juice, which is mixed with boiled milk and given in syphilis, and combined with opium is used with great success in gonorrhœa. Ainslie notices the application of the leaf, when bruised and mixed with castor oil, to obstinate psora (the Carpang of the Tamils). The plant is also thought to stimulate uterine contraction, and is administered in tedious labour and as an emmenagogue. In Dalzell and Gibson's *Flora of Bombay* (p. 225) it is spoken of as possessing a merited reputation as an antiperiodic in intermittent fevers. The native doctors in Bombay make a paste with water, of the plant, along with the seeds of *Barringtonia acutangula, Celastrus paniculata*, and black pepper, and rub the whole body with it for the cure of malarial fevers.

The evidence collected by Dr. Watt (*Dict. Econ. Prod. India*, i., 314) shows that it is the opinion of several European physicians in different parts of India that the plant has a decided action upon the uterus, and increases or induces uterine contractions. There appears to be no doubt as to its anthelmintic properties.

Description.—The drug consists of the whole plant in fruit; the stems are striated, slender, and about as thick as a piece of whipcord; the leaves are of a pale, glaucous green, obtuse, heart-shaped, with wavy edges, about 2 inches long and 1½ inch broad, when dry they are blackish; the capsules are ovate, ¾ of an inch long, ribbed, depressed at the apex, six-celled;

each cell contains a column of heart-shaped flat seeds, closely packed. The appearance of the seeds is peculiar, they look as if they had been cut out with a punch; one side is flat, black, and rough from a number of irregular projections; the other is almost entirely occupied by two brown comparatively smooth lobular projections of a soft corky structure; these under the microscope are seen to be entirely composed of ovate, empty, dotted cells. The whole plant is nauseously bitter.

Chemical composition.—The plant contains a nauseous volatile substance, an alkaloid, and a large quantity of salts. The alkaloid is amorphous and gives no colour reactions with the strong mineral acids. The bitter concentrated tincture on standing deposited cubical crystals of potassium chloride. The ash calculated on the air-dried plant was 17·75 per cent., and strong alkaline fumes were given off from the plant when burning.

Commerce.—Value, Rs. 3½ per maund of 37½ lbs.

Zarawand-i-gird (*Pers., Ind. Bazars*). The imported root of *Aristolochia rotunda*, Linn., *Guib. Hist. Nat.*, ii., p. 371, a small plant with slender stems and almost sessile, obtusely cordiform leaves. The flowers are solitary in the axils of the leaves, tubular, yellow without, and orange brown within. The whole plant is acrid, aromatic and bitter. The root is tuberous, placentiform, hard and heavy when dry, more or less mammillated on the under surface, of a reddish-brown colour; on the upper surface are the remains of several stems or small pits showing where they were attached; on the under surface one central scar marking the attachment of the rootlets. The substance is very hard and horny, and has a bitterish somewhat aromatic taste, and camphoraceous odour.

Zarawand-i-tawil (*Pers., Ind. Bazars*). The imported root of *Aristolochia longa*, Linn., *Mill. Ic.*, *t.* 51, *f.* 2, a plant much resembling *A. rotunda*, and having a similar habitat. It differs from the latter plant in having petioled leaves, yellow flowers striped with brown, and a cylindrical root which has much the same taste and odour as that of *A. rotunda.* Mahometan

physicians describe it as resolvent, deobstruent, diuretic, emmenagogue, alexipharmic, and vermifuge.*

These Aristolochias were formerly considered to be antidotes for snake-bites. Albertus Magnus (*De mirabilibus Mundi*) says:—"Si vis statim interficere serpentem, accipe ex Aristolochia rotunda quantum vis et tere illam bene, et accipe ranam sylvestrem vel campestrem et contere ipsam et commisce eam Aristolochia, et pone cum eo aliquid ex incausto, et scribe cum eo in charta aut aliquo quod plus amas, et projice ad serpentes."

Zaráwand-i-gird, or mudahraj, is considered by Persian writers on Materia Medica to be the female of *Aristolochia longa*. Mír Muhammad Husain tells us that at Ispahan it is called Nukhud-i-alwandi. Mahometan physicians describe it as resolvent, stimulating, pectoral, stomachic, and cephalic; they prescribe it in jaundice and gout. True Zaráwand-i-gird is very scarce in India; most of the druggists, when asked for it, supply the small starchy, inert tuber of an arum.†

The Aristolochias are still collected by herbalists in Southern Europe for medicinal use.

PIPERACEÆ.

PIPER NIGRUM, *Linn.*

Fig.—*Miq. Ill. Pip.* 50, *t.* 50; *Bot. Mag.*, *t.* 3139; *Bentl. and. Trim.*, *t.* 245; Black Pepper (*Eng.*), Poivre noir (*Fr.*).

Hab.—Travancore and Malabar. Cultivated elsewhere. The fruit.

Vernacular.—Mirach, Káli-mirach (*Hind.*), Gol-marich (*Beng.*), Milagu (*Tam.*), Miriyálu (*Tel.*), Kuru-mulaka (*Mal.*), Menasu (*Can.*), Miri, Káli-miri (*Mar.*), Kalo-miri (*Guz.*). White

* Compare with the description of the two Aristolochias in Dioscorides (iii., 4) περὶ αριστολοχίας στρογγύλης. Pliny mentions their use by women to procure male offspring, and Apuleius recommends them as a protective against the evil eye.

† *Pinellia tuberifera*, Tenore, the *Sang-pwan-hea* of the Chinese, growing about Pekin (*Hance*, *Linn. Journ. Bot.*, xiii. (1872), 88), figured and described by Hanbury. (*Science Papers*, p. 262.)

pepper bears the same names with the addition or substitution of the adjective "white."

History, Uses, &c.—The earliest travellers from the West who visited India, found the pepper vine in cultivation on the Malabar Coast. Theophrastus (H. P. ix., 22) mentions two kinds of pepper (πίπερι or πέπερι) in the fourth century B. C., and Dioscorides (ii., 148) mentions λευκον πέπερι, white pepper, μακρόν πέπερι, long pepper, and μέλαν πέπερι, black pepper. Pliny says:—"It is quite surprising that the use of pepper has come so much into fashion, seeing that in other substances which we use, it is sometimes their sweetness, and sometimes their appearance, that has attracted our notice; whereas, pepper has nothing in it that can plead as a recommendation to either fruit or berry, its only desirable quality being a certain pungency; and yet it is for this that we import it all the way from India! Who was the first to make trial of it as an article of food? and who, I wonder, was the man that was not content to prepare himself, by hunger only, for the satisfying of a greedy appetite?" (12, 14.)

In the Periplus of the Erythrean Sea, written about A.D. 64, it is stated that pepper is exported from Baraké, the shipping place of Nelkunda. in which region, and there only, it grows in great quantity. These have been identified with places on the Malabar Coast between Mangalore and Calicut.

Long pepper and Black pepper are among the Indian spices on which the Romans levied duty at Alexandria about A.D. 176.

Cosmas Indicopleustes, a merchant, and in later life a monk, who wrote about A.D. 540, appears to have visited the Malabar Coast, or at all events had some information about the pepper-plant from an eye-witness. It is he who furnishes the first particulars about it, stating that it is a climbing plant, sticking close to high trees like a vine. Its native country he calls *Male.* The Arabian authors of the Middle Ages, as Ibn Khurdádbah (*circa* A.D. 869-885), Edrisi in the middle of the 12th, and Ibn Batuta in the 14th century, furnished nearly similar accounts.

Among Europeans who described the pepper-plant with some exactness, one of the first was Benjamin of Tudela, who visited the Malabar Coast in A.D. 1166. Another was the Catalan friar, Jordanus, about 1330; he described the plant as something like ivy, climbing trees and forming fruit, like that of the wild vine. "This fruit," he says, "is at first green, then, when it comes to maturity, black." Nearly the same statements are repeated by Nicolo Conti, a Venetian, who, at the beginning of the 15th century, spent twenty-five years in the East. He observed the plant in Sumatra, and also described it as resembling ivy. (*Pharmacographia.*)

The high cost of pepper contributed to incite the Portuguese to seek for a sea passage to India, and the trade in this spice continued to be a monopoly of the Crown of Portugal as late as the 18th century.

In January 1793, an agreement was made between the Rajah of Travancore and the English, by which he was to supply a large quantity of pepper to the Bombay Government in return for arms, ammunition and European goods; this was known as the "Pepper Contract."

It is worthy of remark that all the foreign names for black pepper are derived from Pippali, the Sanskrit name for long pepper, which leads one to suppose that the latter spice was the first kind of pepper known to the ancient Persians and Arabs, through whose hands it first reached Europe. Their earlier writers describe the plant as a shrub like the Pomegranate (*P. chaba ?*). The moderns apply the name Filfil (Pilpil, *Pers.*) to all kinds of pepper. Black pepper is called in Sanskrit Maricha, which means a "pungent berry." The word is derived from Marichi, "a particle of light or fire," and appears to have been first applied to the aromatic berries known as Kakkola; it now signifies black and red pepper, and in the vernacular forms of Mirach or Mirchai, is a household word in India.

Maricha is described in the Nighantas as bitter, pungent, digestive, hot and dry; synonyms for it are Valli-ja "creeper grown," Ushana, Tikshna "pungent," Malina, Syama "black," &c. It is said to be useful in intermittent fever, hæmorrhoids,

dyspepsia, cough, gonorrhœa and flatulence, and to promote the secretion of bile. Together with long pepper and ginger it forms the much-used compound known as Trikatu, "the three acrids," or "Ushana-chatu-rushana." Externally, pepper is used as a rubefacient and stimulant of the skin. In obstinate intermittent fever and flatulent dyspepsia, the Hindus administer white or black pepper in the following manner:—A tablespoonful is boiled overnight in one seer of water, until the water is reduced to one-fourth of its bulk, the decoction is allowed to cool during the night, and is taken in the morning. The pepper is then again boiled in the same manner and the decoction taken at night. This treatment is continued for seven successive days. A compound confection of pepper (*Pránada gudiká*) is given as a remedy for piles; it is made in the following manner:—Take of black pepper 32 tolas, ginger 24 tolas, long pepper 16 tolas, *Piper chaba* (chavya) 8 tolas, leaves of *Taxus baccata* (tálisa) 8 tolas, flowers of *Mesua ferrea* (nágkesar) 4 tolas, long pepper root 16 tolas, cinnamon leaves and cinnamon one tola each, cardamoms and the root of *Andropogon muricatus* (usira) 2 tolas each, old treacle 240 tolas; rub them together. Dose about 2 drachms. When there is costiveness, chebulic myrobalans are substituted for ginger in the above prescription. (*Chakradatta.*)

The use of pepper for the cure of intermittents is strongly recommended by Stephanus in his commentary on Galen, and recently some cases of refractory intermittent fever, in which, after the failure of quinine, piperine has been administered with advantage, are reported by Dr. C. S. Taylor (*Brit. Med. Journ.*, Sept., 1886). In one case, immediately on the accession of an attack, three grains of piperine were given every hour, until eighteen grains had been taken, and on the following day, when the intermission was complete, the same dose was given every three hours.

Mahometan physicians describe black pepper as deobstruent, resolvent, and alexipharmic; as a nervine tonic it is given internally, and applied externally in paralytic affections; in toothache it is used as a mouth-wash. As a tonic and digestive, it is given in dyspepsia. With vinegar it forms a good

stimulating poultice. With honey it is useful in coughs and colds. Moreover, it is diuretic and emmenagogue, and a good stimulant in cases of bites by venomous reptiles. Strong friction with pepper, onions, and salt is said to make the hair grow again upon the bald patches left by ringworm of the scalp. They notice the use of the unripe fruit, preserved in salt and water as a pickle, by the natives of Malabar.

De Gubernatis draws attention to the following passage from the travels of Vincenzo Maria da Santa Caterina (iv., 3) with reference to white pepper being offered by the Hindus to their gods in Malabar:—"Da Malavari è tenuto in stima grandissima, eli Gentili d'ordinario l'offrono a 'loro Dei, si per la rarità come per la virtù salutifera e medicinale, che da quello sperimentano, riportandolo poi alli infermi." For the early history of pepper in Europe, the *Pharmacographia* may be consulted.

Cultivation.—Its cultivation is very simple, and is effected by cuttings or suckers put down before the commencement of the rains in June. The soil should be rich, but if too much moisture be allowed to accumulate near the roots, the young plants are apt to rot. In three years the vine begins to bear. They are planted chiefly in hilly districts, but thrive well enough in the low country in the moist climate of Malabar. They are usually planted at the base of trees which have rough or prickly bark, such as the jack, the erythrina, cashewnut, mango-tree, and others of similar description. They will climb about 20 or 30 feet, but are purposely kept lower than that. During their growth it is requisite to remove all suckers, and the vine should be pruned, thinned, and kept clean of weeds. After the berries have been gathered, they are dried on mats in the sun, turning from red to black. They must be plucked before they are quite ripe, and if too early they will spoil. White pepper is the same fruit freed from its outer skin, the ripe berries being macerated in water for the purpose. In this latter state they are smaller, of greyish-white colour, and have a less aromatic or pungent taste. The pepper-vine is very common in the hilly districts of Travancore, especially in the Cottayam, Meenachel, and Chenganacherry districts, where, at an average calculation,

about 5,000 candies are produced annually. It is a Government monopoly. (*Drury.*)

Description.—The immature fruit, known as Black Pepper, is globular, about $\frac{1}{5}$ of an inch in diameter, much wrinkled, and of a brown-black colour; on one side are the remains of the peduncle, and on the other of the style and stigmas. The pericarp is closely adherent to the seed. The latter consists of a thin reddish-brown testa and a copious albumen, the exterior portion of which is horny and the interior farinaceous. The embryo is undeveloped. The mature seed, known as White Pepper, is less acrid than Black, as the pericarp has been removed; it is also rather smaller and of a grey colour, striated from base to apex by about a dozen light stripes.

The transverse section of a grain of black pepper exhibits a soft, yellowish epidermis covering the outer pericarp. This is formed of a closely-packed yellow layer of large, mostly radially arranged, thick-walled cells, each containing in its small cavity a mass of dark-brown resin. The middle layer of the pericarp consists of soft, tangentially-extended parenchyme, containing an abundance of extremely small starch granules and drops of oil. The shrinking of this loose middle layer is the chief cause of the deep wrinkles on the surface of the berry. The next inner layer of the pericarp exhibits towards its circumference, tangentially-arranged soft parenchyme, the cells of which possess either spiral striation or spiral fibres, but towards the interior, loose parenchyme free from starch and containing very large oil cells.

The testa is formed in the first place of a row of small yellow thick-walled cells. Next to them follows the true testa, as a dense, dark-brown layer of lignified cells, the individual outlines of which are undistinguishable.

The albumen of the seed consists of angular, radially arranged, large-celled parenchyme. Most of its cells are colourless and loaded with starch; others contain a soft, yellow, amorphous mass. If thin slices are kept under glycerine for some time,

these masses are slowly transformed into needle-shaped crystals of piperin. (*Pharmacographia.*)

Chemical composition.—Black pepper contains an acrid resin, a volatile oil, starch, gum, a small quantity of fatty oil in the mesocarp, and about 5 per cent. of inorganic matter, besides the alkaloid *piperine*, and a volatile alkaloid which is probably identical with *piperidine*. The acrid resin is dark-green, soluble in alcohol, ether and alkalies, and, in connection with other constituents of pepper, also in water. C. Heisch (*Analyst*, xi., 186-190) has shown that pepper should contain not less than 50 per cent. of starch, which is characterised by the smallness of its granules. The essential oil has been examined by L. A. Eberhardt (*Archiv. d. Pharm.* (3), XXV., 515-519); it had a sp. gr. of 0·87352 at 15° C., and showed a greenish colour, due neither to chlorophyll nor to copper. At 22° the oil had a lævorotatory power of 3·2° in a column 100 mm. long. On rectification a very small quantity passed over at 160°. Fractions obtained at 170°, 176° and 180° were colourless; that obtained at 190° faint green, and that at 250° green, that passing over at 310° brown-green. Above 310° a brown, tenacious residue was obtained in which phenol could not be detected. The 170° fraction, when rectified under reduced pressure, gave a terpene boiling at 164°—165°, and showed a left-handed rotation of 7·6° in 100 mm.; it gave numbers agreeing with the formula $C^{10}H^{16}$.

The composition of the other fractions was much the same as this. The oil consists of a lævorotatory terpene and isomeric compounds of higher boiling point. (*Journ. Chem. Soc.*, Oct., 1887; *Year-Book Pharm.*, 1888.)

Pure piperine crystallizes in colourless flat, four-sided prisms of a glassy lustre and almost tasteless. As usually met with, it is of a yellowish colour, inodorous, and has at first a slight, but on continued mastication, or in alcoholic solution, a sharp, peppery taste. It remains unaltered on exposure, has a neutral reaction to test-paper, is nearly insoluble in water, and dissolves in volatile oils, in 60 parts of cold ether (*Merck*), in 30 parts of cold

and in 1 part of boiling 80 per cent. alcohol (*Wittstein*), and freely in acetic acid; the last two solutions are precipitated on the addition of water. It is likewise soluble in chloroform, benzol, and benzin. At 129° C. it melts like wax to a yellowish oily liquid, which on cooling congeals to a mass of resinous appearance; when fused it may be ignited, and burns with a bright flame, leaving a light charcoal, which is readily consumed by heating it in the air. Sulphuric acid colours it blood-red, the colour disappearing on the addition of water, leaving the piperine unaltered if the action of the acid has not been prolonged (*Pelletier*). The solution of piperine in sulphuric acid is yellow, becoming dark-brown, and finally green-brown (*Dragendorff*). Nitric acid colours piperine successively greenish-yellow, orange, and red, and dissolves it with a yellow colour, the solution separating yellow floccules on the addition of water; by prolonging the action of the acid, oxalic acid and a yellow bitter compound are produced (*Pelletier*). The resin resulting from this reaction becomes blood-red on the addition of potassa, and on heating the mixture piperidine is given off (*Anderson*, 1850). Piperine is a very weak base, and its salts are decomposed by water; crystallizable double salts, soluble in alcohol, may be obtained with the chlorides of mercury, platinum, and cadmium. By dry distillation with soda-lime piperidine is obtained. Boiled with alcoholic solution of potassa, piperine was found by Babo and Keller (1856) to be resolved into *piperic acid*, $C^{12}H^{10}O^{4}$, and *piperidine*, $C^{5}H^{11}N$. Piperic acid is in hair-like, yellowish, needles which fuse at 150° C., and at a higher temperature volatilize partly unaltered, at the same time giving off a coumarin-like odour. Piperidine is a colourless liquid of an ammoniacal and pepper-like odour, and when largely diluted of a bitter taste. It boils at 106° C., has a strong alkaline reaction, dissolves freely in water and alcohol, and yields with acids crystallizable salts; the piperate of piperidine crystallizes in silky scales, which, on being heated, give off a part of the alkaloid. Ladenburg (1884) obtained a small quantity of piperidine synthetically by treating an alcoholic solution of pyridine with sodium. (*National Dispensatory.*) Heisch

(*Analyst*, 1886) gives the following analysis of pure and commercial peppers:—

	Water.	Total ash.	Ash soluble in water.	Ash soluble in acid.	Insoluble ash.	Alkalinity as K^2O.	Starch.	Alcoholic extract.	Piperin.
Black berry ...	9·22 to 14·36	4·35 to 8·93	1·54 to 3·34	1·51 to 3·83	·36 to 4·38	·72 to 1·57	48·53 to 56·67	10·47 to 16·2	4·05 to 9·38
White berry ...	13·67 to 17·32	1·28 to 8·78	·217 to ·618	·84 to 2·80	·22 to ·69	... ·22	76·27 to 77·68	9·23 to 9·73	5·13 to 6·14
Fine ground white	13·90	1·58	·16	·9	·52	...	75·31	10·66	4·51
Long pepper	12·15	13·48	2·28	5·52	5·68	·53	58·78	8·29	1·71
Adulterated ground	11·12	14·7	2·02	4·07	8·61	·78	35·85	11·57	2·02

W. Johnstone (*Chem. News*, Nov., 1889) has shown that pepper contains a volatile alkaloid probably identical with piperidine. Black pepper yielded 0·56 per cent., and the husks alone 0·74 per cent., of this base. White pepper yielded it also, but in smaller quantity, and the larger proportion of piperidine in the husk, the author considers to be an explanation of the greater pungency of black pepper as compared with white pepper. Long pepper was found to yield 0·34 per cent. of the alkaloid. (*Year-Book Pharm.*, 1889.)

Commerce.—The exports of pepper from the Malabar Coast for the past 6 years have been—

	Cwts.
1884-85	91,516
1885-86	100,804
1886-87	106,976
1887-88	136,605
1888-89	101,177
1889-90	141,257

The Travancore State exports annually about 3,000 candies of pepper, each candy containing 500 English lbs., and this brings to the State an annual income of 6 lakhs of rupees.

Adulteration.—As pepper is always sold whole in India, it is seldom adulterated. We have occasionally met with an admixture of the berries of *Embelia Ribes*, and the fruit of *Mirabilis Jalapa* is stated to be sometimes mixed with it.

The abortive berries of **P. troicium**, *Roxb.*, now considered to be the wild form of *P. nigrum*, are known in Western India as Pokali-miri, and the plant as Kokervel in Marathi and Murialtiga in Telugu. Garcia d' Orta notices the drug under the name of Canarese pepper, and observes that it never finds its way to Portugal, but is valued as a medicine by the natives to purge the brain of phlegm, to relieve toothache, and as a remedy for cholera.

This plant was first described by Roxburgh, who found it growing wild in the hills north of Samulcotta.

It was growing plentifully about every valley among the hills, delighting in a moist rich soil, and well shaded by trees; the flowers appearing in September and October, and the berries ripening in March. Roxburgh commenced a large plantation, and in 1789 it contained about 40,000 or 50,000 pepper-vines, occupying about 50 acres of land. The produce was great, about 1,000 vines yielding from 500 to 1,000 lbs. of berries. He discovered that the pepper of the female vines did not ripen properly, but dropped while green, and that when dried it had not the pungency of the common pepper; whereas the pepper of those plants which had the hermaphrodite and female flowers mixed on the same ament was exceedingly pungent, and was reckoned by the merchants equal to the best Malabar pepper.

Pliny (12,14) mentions abortive pepper seeds known by the name of "Bregma," a word which in the Indian language signifies "dead." He remarks that it is the most pungent kind of pepper.

Lendi-pipali. Globular catkins of a species of pepper occasionally found in the Bombay market, said to come from Singapore. They are of the size of the pellets of sheep's dung, hence the name Lendí-pípalí. The taste is very hot and acrid.

The individual fruits are nearly as large as cardamom seeds, the whole catkin having much the appearance of a small blackberry.

PIPER CHABA, *Hunter.*

Fig.—*Miq. Ill. Pip., t.* 34; *Hayne, Arnz., Gewachs. xiv., t.* 21; *Wight Ic., t.* 1927. Long Pepper (*Eng.*), Poivre long (*Fr.*).

Hab.—Cultivated in India and the Malay Islands. The fruit and stem.

Vernacular.—Cháb (*Hind.*), Chai (*Beng.*), Chavak (*Mar.*).

PIPER LONGUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 244; *Miq. Ill. Pip., t.* 30; *Hayne, Arnz. Gewachs. xiv., t.* 20; *Wight Ic., t.* 1928; *Rheede, Hort. Mal. vii., t.* 14.

Hab.—Hotter provinces of India. The fruit and root.

Vernacular.—The fruit.—Pipal, Pippali (*Hind.*), Tippili (*Tam.*), Pippallu (*Tel.*), Tippali (*Mal.*), Yippali (*Can.*), Pipul (*Beng.*), Bangáli-pipali (*Mar.*), Pipara (*Guz.*). The root.—Pippali-múl, Pipla-múl, Pipla-mur (*Hind.*), Tippili-mulam, Tippili-vér (*Tam.*), Modi, Pippali-katta (*Tel.*), Tippili-vér (*Mal.*), Pipuli-múl (*Beng.*), Pipali-múl (*Mar., Guz.*).

History, Uses, &c.—As we have already stated, we think it highly probable that long pepper was the kind of pepper first known to the ancient inhabitants of Western Asia and Europe. (See *P. nigrum.*) In Sanskrit works on medicine, *P. longum* is described under the name of Pippali, and bears the synonyms of Chapalá, Pála, Mágadhi "growing in South Bihar," Kaná, Shaundi, &c. It is considered to be digestive, sweet, cold, bitter, emollient and light; useful in rheumatism, asthma, cough, abdominal enlargements, fever, leprosy, gonorrhœa, piles and spleen. Old long pepper is to be preferred to fresh. A mixture of long pepper, long pepper root, black pepper and ginger in

equal parts, is prescribed by several writers as a useful combination for catarrh and hoarseness. As an alterative tonic, long pepper is recommended for use in a peculiar manner. An infusion of three long peppers is to be taken with honey on the first day, then for ten successive days the dose is to be increased by three peppers every day, so that on the tenth day the patient will take thirty at one dose. Then the dose is to be gradually reduced by three daily, and finally the medicine is to be omitted. Thus administered, it is said to act as a valuable alterative tonic in paraplegia, chronic cough, enlargements of the spleen and other abdominal viscera. Long pepper and black pepper enter into the composition of several irritating snuffs; boiled with ginger, mustard oil, buttermilk and curds it forms a liniment used in sciatica and paralysis. In the Concan the roasted aments are beaten up with honey and given in rheumatism; they are also given powdered with black pepper and rock salt (two parts of long pepper, three of black, and one of salt) in half tolá doses for colic. Mahometan writers, under the name of Dárfilfil, describe long pepper as a resolvent of cold humours; they say it removes obstructions of the liver and spleen, and promotes digestion by its tonic properties; moreover, it is aphrodisiacal, diuretic, and emmenagogue. Both it and the root (Filfil-muiyeh) are much prescribed in palsy, gout, lumbago, and other diseases of a similar nature. A collyrium of long pepper is recommended for night blindness; made into a liniment it is applied to the bites of venomous reptiles. We learn from Roxburgh (*Flora Indica*, I., p. 155) "that it is in Bengal only that *Piper longum* is cultivated for its pepper. When the ament is full-grown, it is gathered and daily exposed to the sun till perfectly dry; after which it is packed in bags for sale. The roots and thickest part of the creeping stems, when cut into small pieces and dried, form a considerable article of commerce all over India, under the name of Pippali-mula, for which purpose it is particularly cultivated in many of the valleys amongst the Sircar mountains. This sort is more esteemed, and bears a higher price than that of Bengal, where by far the largest

portion is cultivated. It, as well as the pepper, is chiefly employed medicinally, and the consumption of both these drugs is very great." *Piper longum* was formerly cultivated at Poway, near Bombay; it appears to grow well in gardens in Bombay, but requires plenty of manure.

Pippali-mula, with the synonyms Kana-mula, Katu-granthi, Ushana-granthika, Chataka and Chataka-shira, is described in the Nighantas as having the same properties as long pepper. *P. Chaba,* which produces the long pepper of European commerce, is the Chavi, Chavika and Chavya of Sanskrit writers. It is considered to have the same properties as *P. longum.* The aments are sold in the bazars as Mothi pippali, and the stem as Cháb, Chai or Chavak.

The oblong black pepper of Theophrastus (H. P., ix., 22) was probably long pepper. Dioscorides, in his article upon the three peppers, mentions a pepper root, and says it resembles Costus, has a hot taste, and causes salivation when chewed. This drug was probably Galangal, which is known as Pán-ki-jar or root of *Piper Betle,* because its odour somewhat resembles that of Betle leaves.

Description.—The ament of *P. Chaba,* the long pepper of European commerce, consists of a multitude of minute baccate fruits, closely packed round a common axis, the whole forming a spike 1½ inch long and ¼ inch thick. The spike is supported on a stalk ½ an inch long; it is rounded above and below, and tapers slightly towards its upper end. The fruits are ovoid, $\frac{1}{10}$ of an inch long, crowned with a nipple-like point (stigma), and arranged spirally with a small peltate bract beneath each. Beneath the pericarp, the thin brown testa encloses a colourless albumen, of which the obtuser end is occupied by the small embryo. The colour of commercial long pepper is greyish-white, as if it had been rolled in some earthy powder. When washed the spikes are reddish-brown. The drug has a burning aromatic taste, and an agreeable odour.

The ament of *P. longum* has a similar structure, but is shorter, more slender and less pungent. When fresh it has hardly any

aroma, but in the process of drying it gradually developes an aromatic taste and odour.

Pippali-mula, or pepper root, when fresh, is a fleshy, crooked, and knotted root about the size of a goose-quill, with many smaller rootlets branching from it. The cortical portion is very thick, and covered by a thin smooth brown epidermis. The central woody column is soft and divided into from 4 to 6 wedge-shaped portions by from 4 to 6 very conspicuous medullary rays.

Microscopic structure.—The epidermis of the root consists of several rows of tangentially extended brown cells. The parenchyme of the cortex is chiefly composed of large thin-walled cells loaded with starch, and containing drops of essential oil. Amongst them are scattered cells containing a refractive yellow substance (resin). The central woody column is also loaded with starch, and contains as many resin-cells as the cortex. The medullary rays are abundantly provided with large scalariform vessels.

Chemical composition.—The constituents of long pepper are the same as those of black pepper.

A third kind of long pepper is met with in the bazars, which is known as Swaheli or Sugandhi-pippali, and is imported from Zanzibar. It has a peculiarly fragrant odour, and is administered with honey as a remedy for cough; it has not the acridity of the other long peppers.

The aments are from 1 to 2½ inches in length, flexuose, many of them barren or nearly so, only one or two fruits having come to maturity. These aments are almost filiform. The peduncle is about one inch long. The mature fruit after being soaked in water is $\frac{1}{12}$ inch in diameter, pyriform, mucronate (the *mucro* bifurcated), sessile; it consists of a pulpy envelope enclosing a somewhat pyriform seed resembling in structure that of other peppers.

Commerce.—Three kinds of long pepper are met with in the Indian market—1*st*, Singapore, which is identical with the long pepper of European commerce; 2*nd*, Bangáli, the produce of *P. longum*, cultivated in Bengal; 3*rd*, Swaheli, imported from Zanzibar.

Value, Singapore, Rs. 7 to Rs. 12 per maund of 41 lbs.; Bengal, Rs. 9; Zanzibar, Rs. 5. Pippali-mul is also of three kinds: Mirzapore, Rs. 10 to Rs. 40; Bengal, Rs. 7 to Rs. 7¼; Malwa, Rs. 50 per maund of 41 lbs.

PIPER CUBEBA, *Linn. f.*

Fig.—*Bentl. and Trim., t.* 243. Cubebs (*Eng.*), Cubèbes (*Fr.*)

Hab.—Java. The fruit.

Vernacular.—Kabáb-chini, Kankol (*Hind.*), Kankola (*Mar.*), Vál-milaku (*Tam.*), Toka-miriyalu, Chalava-miriyalu (*Tel.*), Vál-mulaka (*Mal.*), Bála-menasu (*Can.*), Chini-kabáb (*Guz.*).

History, Uses, &c.—Cubebs were introduced into medicine by the Arabian physicians of the Middle Ages. Masudi in the 10th century stated them to be a production of Java. The author of the *Sihah,* who died in 1006, describes Kabábeh as a certain medicine of China. Ibn Sina, about the same time, notices it as having the properties of madder, but a more agreeable taste, and states that it is said to possess hot and cold properties, but is really hot and dry in the third degree, a good deobstruent, and useful as an application to putrid sores and pustules in the mouth; it is also good for the voice and for hepatic obstructions; a valuable diuretic, expelling gravel and stone from the kidneys and bladder. He concludes by stating that the application of the saliva, after chewing it, increases the sexual orgasm. Later Mahometan writers have similar accounts of Kabábeh, and say that it is called Hab-el-arús, "bridegroom's berry," and that Greek names for it are Mahilyun (μάχλόν?), and Karfiyun, evidently a corruption of καρπήσιον, the name of an aromatic wood mentioned by Paulus Ægineta. It appears that cubebs were at one time known as *Fructus carpesiorum* in Europe. In the Rája Nirghanta, which was written about 600 years ago, cubebs appear under the name of Kankola, and the same name appears in the Hindi and Marathi Nighantas. Madanpal gives Katuka-kola, "pungent pepper," as a synonym for it. All the Sanskrit names appear to be of comparatively recent origin. The authors of the *Pharmacographia* draw

attention to the fact that the action of cubebs upon the urino-genital organs, though known to the old Arabian physicians, was unknown to modern European writers on Materia Medica at the commencement of the present century. According to Crawfurd, its importation into Europe, which had long been discontinued, recommenced in 1815, in consequence of its medicinal virtues having been brought to the knowledge of the English medical officers serving in Java, by their Hindu servants. (*Op. cit.*, 2*nd Ed.*, p. 585.) In earlier times cubeb pepper was used in Europe as a spice, as it still is, to some extent, in the East.

Description.—The fruits are elevated on a kind of stalk, formed from the contraction of the base of the fruit itself, so that they are not really but only apparently stalked.

The dry berries are spherical, wrinkled, of a brown colour, and are easily distinguished from black pepper by the pedicel at their base; beneath the pericarp is a nut which contains the seed. The albumen is white and oily. As the fruit is gathered when immature, the drug usually consists of little else than the pericarp. The mature fruit which is sometimes met with in the Indian Bazars should be rejected.

Microscopic structure.—The pericarp consists of an epidermis, beneath which is an interrupted row of small thick-walled cells. Within this the parenchyme is composed of cells containing starch and oil; in the latter, bundles of needle-shaped crystals of cubebin may be observed; lastly, the innermost layer of the pericarp is formed by several rows of tangentially extended cells containing essential oil. The nut is yellow and brittle. The seed when present is seen to contain crystals of cubebin.

Chemical composition.—The most obvious constituent of cubebs is the volatile oil, the proportion of which yielded by the drug varies from 4 to 13 per cent. The oil, when freshly distilled, is slightly greenish, but becomes colourless on rectification. It has the odour of cubebs, and a warm aromatic comphoraceous taste. Its density varies between 920 and 936 at 15° C. The causes of the great variation in the yield of oil may be found in

the constitution of the drug itself, as well as in the alterability of the oil, and the fact that its prevailing constituents do not begin to boil below 264° C. Cubeb oil was shown by Oglialoro to be a mixture of a turpene boiling at 158° to 163°, which is present to a very small amount, and two oils of the formula $C^{15}H^{24}$, boiling at 262° to 265° C. One of the latter deviates the plane of polarization strongly to the left, and yields a crystalline compound, $C^{15}H^{26}Cl^2$, melting at 118° C. The other hydrocarbon is less lævogyrate, and does not combine with HCl. (*Deut. Chem. Ges. Ber.*, viii., 1357.) Cubeb oil mixes with glacial acetic acid in all proportions; iodine gives a violet coloration without perceptible reaction; with nitric acid it becomes opaque, and on heating a pale red tint is afforded. (*Brannt.*) One part of oil, diluted with about 20 parts of bisulphide of carbon, assumes at first a greenish, and afterwards a blue coloration, if one drop of a mixture of equal weights of concentrated sulphuric and nitric acids is shaken with the solution. The oil distilled from old cubebs, on cooling after a time, is stated to deposit large, transparent, inodorous octohedra of *camphor of cubebs*, $C^{30}H^{48} + 2OH^2$, belonging to the rhombic system, which melt at 65°, and sublime at 148°. But the authors of *Pharmacographia* failed to obtain crystals after keeping the oil of fresh cubebs for two years in contact with water, to which a little nitric acid had been added.

Another constituent of cubebs is *Cubebin*, crystals of which may sometimes be seen in the pericarp even with a common lens. It was discovered by Soubeiran and Capitaine in 1839; it is an inodorous substance, crystallizing in small needles or scales, melting at 125°, having a bitter taste in alcoholic solution. It dissolves freely in boiling alcohol, but is mostly deposited upon cooling; it requires 30 parts of cold ether for solution, and is also abundantly soluble in chloroform. Flückiger and Hanbury found this solution to be slightly lævogyre, and to turn red on addition of concentrated sulphuric acid. If the solution of cubebin in chloroform is shaken with phosphoric anhydride, it turns *blue*, and gradually becomes red on absorption of

moisture. Cubebin is nearly insoluble in cold, but slightly soluble in hot water. Bernatzik (1866) obtained from cubebs 0·40 per cent. of cubebin, Schmidt (1870) 2·5 per cent. The crystals, which are deposited in an alcoholic or ethereal extract of cubebs, consist of impure cubebin. Cubebin is devoid of any remarkable therapeutic action; its composition, according to Weidel (1877), answers to the formula $C^{10}H^{10}O^{3}$; by melting it with caustic potash, it is resolved into acetic and protocatechuic acids.

The resin extracted from cubebs consists of an indifferent portion nearly 3 per cent., and of *Cubebic Acid*, amounting to about 1 per cent. of the drug. Both are amorphous, according to Schmidt, like the salts of cubebic acid. Bernatzik, however, found some, as the barium salt, to be crystallizable. Schulze (1873) prepared cubebic acid from the crystallized sodium-salt, but was unable to obtain it crystalline. The resins, the indifferent as well as the acid, possess the therapeutic properties of the drug. Schmidt further pointed out the presence in cubebs of gum (8 per cent.), fatty oil, and malates of magnesium and calcium. The yield of ash, according to Warnecke, is 5·45 per cent.

Commerce.—Bombay is supplied with the drug from Singapore. There is a good demand for it, and the consumption in native practice appears to be increasing. Value—Formerly cubebs was obtainable in the Indian markets at from 4 to 5 annas per lb., but for the last eight years the price has been seldom less than Re. 1 per lb.

PIPER BETLE, *Linn.*

Fig.—*Wight Ic.*, *t.* 2926; *Miq. Ill. Pip.*, *t.* 39; *Bot. Mag.*, *t.* 3132; *Rheede, Hort. Mal. vii.*, *t.* 15. Betle Pepper (*Eng.*), Poivrier de Betel (*Fr.*).

Hab.—Cultivated in the hotter parts of India, Ceylon, and Malay Islands. The leaves.

Vernacular.—Pán (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Vettilai (*Tam.*), Nága-valli (*Tel.*), Vetrila (*Mal.*), Viledele (*Can.*).

History, Uses, &c.—According to the Hitopadesa, the Betle-leaf (támbúla) has thirteen properties (Támbúlasya trayodasha gunáh svarge'pi te durlabháh). It is sour, bitter, heating, sweet, salt, astringent; it expels flatulence (vataghna), phlegm (kaphanàsana), worms (krimihara); it removes bad odours; beautifies the mouth, cleans it, and excites voluptuous sensations. According to Hindu tradition, the plant (Nága-valli) was brought from heaven by Arjuna, who stole a branch of it, which he planted on his return to earth. The leaves with Betle-nut and spices form the *vira*, or *pán-súpári*, so much used by the natives of India as a token of civility or affection. It is also given in confirmation of a pledge, promise, or betrothal, and, among the Rajpoots, is sometimes exchanged as a challenge; thus the expression *bira uthana* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dalna*, "to propose a premium" for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "Vetalapanchavinshati," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree, nourishing himself with a smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pan ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not an easy matter.

The betle-leaf was probably the Malabathron or Indian leaf of the Greeks, sometimes called simply "leaf" (φυλλόν), and sold in rolls in a dried state. Dioscorides speaks of its being threaded on strings to dry, a practice which, before the introduction of steam carriage by sea, was common in Bombay among the Indian traders who sent the leaves to their friends at foreign ports. The passage in Dioscorides ἐν τω μελανίζειν τε ἄθραυστον καὶ

ὁλόκληρον is probably corrupt, and should be as suggested by his commentator, M. Vergilius, ἐν τω μαλακίζειν τε ἄθραυστον καὶ ὁλοκληρον, a reading which he found in one manuscript. As regards the fabulous growth of Malabathron as recorded by Dioscorides, it may possibly have originated from a confused account of the method of ripening betle leaves followed in some parts of India. The author of the *Makhzan* states that the leaves, which, when plucked, are always green, are packed in a large kind of basket and covered with rice or wheat straw. A hole is then dug in the ground, of the size of the basket, and a fire lighted in it until the ground becomes warm. The fire is then removed, and the basket of leaves is placed in the hole and covered with stones or any heavy weight so as to press the leaves together; it is kept in this position for 24 hours, and after removal the basket is exposed to the night dew, if it is the hot season, or kept in a warm place, if it is the cold season, until the leaves are of a pale yellow colour and become brittle. That Malabathron was not a cinnamon leaf, is, we think, clear from Dioscorides in his chapter on Cassia, describing its leaves as like those of the pepper plant, thus showing that he was acquainted with cinnamon leaves as distinct from Malabathron.

Ibn Sina describes Támbúl as cold and dry, astringent and desiccative, and notices its use by the Hindus. The author of the *Makhzan-el-Adwiya*, who wrote in India, gives a full account of the different varieties of Betle-leaf produced by cultivation; of the method of ripening the leaves for the market; and of their properties and uses.

Dutt (*Hind. Mat. Med.*, p. 244) has the following concise account of their uses:—"The leaves of this creeper are, as is well known, masticated by the natives of India. The poorer classes make their packet of betle with the addition of lime, catechu, and betle-nuts. The rich add cardamoms, nutmegs, cloves, camphor, and other aromatics; betle-leaf thus chewed acts as a gentle stimulant and exhilarant. Those accustomed to its use feel a sense of langour when deprived of it. The ancient Hindu writers recommend that betle-leaf should be taken early in the morning, after meals and at bed-time. According to

Susruta, it is aromatic, carminative, stimulant, and astringent. It sweetens the breath, improves the voice, and removes all foulness from the mouth. According to other writers it acts as an aphrodisiac. Medicinally it is said to be useful in diseases supposed to be caused by deranged phlegm, and its juice is much used as an adjunct to pills administered in these diseases, the pills being rubbed into an emulsion with the juice of the betle-leaf and licked up. Being always at hand, *Pán* leaves are used as a domestic remedy in various ways. The stalk of the leaf smeared with oil is introduced into the rectum in constipation and tympanitis of children, with the object of inducing the bowels to act. The leaves are applied to the temples in headache for relieving pain, to painful and swollen glands for promoting absorption, and to the mammary gland with the object of checking the secretion of milk. *Pán* leaves are used as a ready dressing for foul ulcers, which seem to improve under them."

The spittle, after chewing *pán súpári*, is red, and is freely ejected by natives, preferably over recently white-washed walls; the dry stains are often mistaken by the police for blood stains, and pieces of plaster, leaves, grass, &c., thus stained have frequently been forwarded to the Chemical Examiner, Bengal, for detection of blood!

Of late years the medicinal properties of betle leaves have been investigated in Europe. Dr. Kleinstuck of Zwatzen, near Jena, has found that the essential oil is of much use in catarrhal affections, inflammations of the throat, larynx and bronchi; it has an antiseptic action. He has also used it in diphtheria as a gargle and by inhalation. The dose is one drop in one hundred grams of water. In India the juice of four leaves may be used similarly diluted.

Cultivation.—The betle garden (*pán-mala*) is a work of art. The best site is the well-drained alluvial bank of a river or stream. The vine is rather fond of an iron soil, but lime, salt, or soda are fatal to it. The well must last throughout the year, be perfectly sweet, and not more than forty feet deep, otherwise the cost of

raising the water eats up the greater part of the profits. The betle-leaf, it is said, cannot be grown from channel water, which is very cold. After the site has been chosen, the next point is to fence it from cattle, thieves, and strong winds. First is an outer line (*kumpan*) of substantial wicker-work, split bamboos, Zizyphus twigs, or other pliable material. Inside of this fence is a thick milk-bush hedge.* Then comes a belt of the large castor plant, and last of all, a row of plantains. The garden is laid out in an invarying pattern. The whole, crosed by water channels and roads, forms beds of different shapes and sizes. Each bed, known by a particular name, such as the *cheritang*, the *bertang*, and the *váfu*, is stocked with a certain number of vines, so that the outturn and other particulars of a garden can be calculated with great nicety. After the ground has been laid out and properly levelled, tree seeds are sown for the vines to train on. Round the edge of each bed is a line of *shevri* (*Sesbania ægyptiaca*), and in the centre from two to three feet apart, the seeds of *hadga* (*Sesbania grandiflora*) and *pangára* (*Erythrina indica*), and from four to six feet apart, single seeds of the *nimb* (*Melia Azadirachta*), are planted. In addition to these, the *popai* (*Carica Papaya*), singly, and plantains in pairs are dotted about, according to the amount of shade required. These seeds are sown in the first week in June (*mriga nakshatra*), and after that, hand-weeding and watering every eight days is all that is wanted up to the end of December (*pushya nakshatra*), when the nurse-trees are eighteen inches to two feet high, or large enough for planting the vines. From the tops of the best ripened shoots, in the old plantations, seven-inch cuttings are taken. They are first made into small bundles, wrapped in plantain leaves, soaked in the water they have been accustomed to, carried to the new plantation, soaked in the new water, and all but the tips buried in the ground. For some time water is given daily; later on once in two days; and afterwards, except during the hot months when it is given every other day, once in six days. From each unburied tip a shoot springs. When they are a few inches long, the shoots are led up the stems of the

* Euphorbia neriifolia.

nurse-trees, and lightly tied with strips of a dried sedge (*path*), so elastic that, without untying it, the pressure of the growing vine keeps it loose. When the vine has grown to the proper height, it is turned back and trained down until it reaches the ground, where it is layered in the earth and again turned up. This is repeated until the tree-stem is fully clothed with vines, when the whole is firmly tied with the dried reeds of the *larála** grass. After this the management of the plantation closely resembles the cultivation of the grape vine in Southern Europe. Leaf-picking may be begun eighteen months after planting, but in the best gardens it is put off till the end of the second year. The leaves may be gathered green and ripened artificially, or they may be left to ripen on the vine, though this reduces their value. The leaf-picker uses both hands, the thumbs sheathed in sharp-edged thimble-like plates, which nip the leaves clean off without wrenching the plant. The vine-grower is either himself a leaf-dealer, or he sells his crop in bulk to a leaf-dealer. Their table of measures is: 400 leaves make a *kavli*; 44 *kavlis* a *kurtan*; and four *kurtans* or 70,400 leaves an *ojhe*. In retail the leaves are sold at from 1—2 annas the hundred. (*Khandesh Gazetteer*, p. 174.)

Description.—The leaves are about five inches long, broadly ovate, acuminate, obliquely cordate at the base, 5 to 7 nerved, coriaceous, and glossy on the upper surface: they have a burning, aromatic and bitter taste.

Chemical composition.—D. S. Kemp of Bombay (1885), by distilling the fresh leaves with water, obtained two pale yellow essential oils, one heavy and the other light, both having the peculiar odour of the leaf, but the light oil being more aromatic. These oils oxidised rapidly, losing their characteristic ethereal odour. The heavy oil was freely soluble in alcohol and ether, sparingly so in chloroform. It had a specific gravity of 1·046 at 84° F., and was slightly lævogyre, (a) j = —·54 for a column 100 mm. long. Prof. J. F. Eijkman's results with oil of betle,

* *Scirpus subulatus*, Vahl., and *Cyperus pertenuis*, Roxb., are both known by this name.

distilled by himself from fresh leaves, which had been in part reported in 1888, have been communicated to the German Chemical Society (*Berichte*, 1889, pp. 2736–2754). The oil was pale greenish-yellow, became golden-yellow and brown on exposure, was slightly lævogyre, and had the sp. gr. 0·969 at 15° C. Caustic potash removed from the oil *chavicol*, a phenol of sp. gr. 1·030 at 15°C., boiling between 236° and 238° C., and having a peculiar odour, somewhat resembling that of creasote; its composition is $C^9H^{10}O$; its aqueous solution is coloured blue by ferric chloride, the colour disappearing on the addition of alcohol; its constitution is expressed by the formula

$$C^6H^4 \begin{cases} OH\ (1) \\ C^3H^5\ (3). \end{cases}$$

The crude chavicol seems to contain a small quantity of a phenol of somewhat higher boiling point, and in alcoholic solution becoming blue with ferric chloride. Betle oil, freed from phenol, did not yield, on fractional distillation, a pure compound in sufficient quantity for examination. The fraction between 173° and 176° contained several terpenes, but no pinene, and had a very agreeable lemon-like odour, while a mint-like odour was observed in the fraction between 190° and 220°. From the higher boiling fraction a hydrocarbon, sesquiterpene, was obtained, having a slight odour, boiling at 260° C., and in acetic solution acquiring a deep indigo-blue colour with bromine. Eijkman calls attention to the betle oil obtained by Schimmel & Co. from dried leaves, and shows that the oil did not contain the above compounds to which the fresh leaves owe their characteristic odour, and which must have been dissipated by drying, or oxidised by exposure, or lost by remaining dissolved in the water; the use of steam under pressure may have volatilized more of the high-boiling phenol than is obtainable by ordinary distillation.

The oil distilled from the dry leaves by Messrs. Schimmel & Co. was a slightly brown-coloured liquid, sp. gr. 1024 at 15°C. It consisted up to about ⅗ or ¾ of a phenol, the boiling point of which in partial vacuum, under a pressure of 12 mm., lay at 131°—132° C.; under ordinary atmospheric pressure it

underwent decomposition on boiling. The sp. gr. of the phenol was 1·067 at 15° C. Examination of the oxidation products, acetyl compound and methyl ether, showed that this compound was not eugenol, but an isomer, the composition of the new compound (iso-eugenol) and of eugenol being represented as follows :—

Iso-eugenol.	Eugenol.
$C^6H^3 \begin{cases} C^3H^5 & (1) \\ OH & (3) \\ OCH^3 & (4) \end{cases}$	$C^6H^3 \begin{cases} C^3H^5 & (1) \\ OCH & (3) \\ OH & (4) \end{cases}$

The second constituent of the oil boiled practically between 250° and 275° C., had a very agreeable tea-like odour, and consisted for the greater part of a sesquiterpene $C^{15}H^{24}$, cubebene, which is characterized by its dihydrochlorate melting at 117°—118° C. (*Berichte von Schimmel & Co.*, 1887.)

At the Narturforscher Meeting in 1888, Professor Eijkman reported that among the constituents of the essential oil distilled from fresh betle leaves, he had found a characteristic compound, having the odour of the leaves and the constitution of parallyl-phenol, which he designated "*chavicol.*" About the same time Messrs. Schimmel announced that the phenol present in the higher-boiling factions of the oil distilled from air-dried betle leaves corresponded completely with eugenol, though subsequently they made the modified statement that the phenol obtained by them was not eugenol, but an isomer (*Pharm. Journ.* [3], xix., 803.) With a view to clearing up the apparent contradiction, Prof. Eijkman has re-examined the oil distilled by himself from the fresh leaves, and some distilled from dry leaves by Messrs. Schimmel, with the result of confirming the presence in the former of chavicol, boiling at 236° to 238° C., and in the latter of the isomer of eugenol, boiling at 254° to 255°, which proved to be orthomethoxychavicol (*Berichte*, xxii., 2735). It would seem probable, therefore, that both phenols occur in the leaves, and that chavicol being the more volatile, had practically disappeared from the dried leaves, while the method of distillation adopted by Messrs. Schimmel favoured the more complete

removal of the higher-boiling compound. Some experiments made with chavicol are said to have shown it to be a powerful antiseptic, it being five times stronger as a bacteriacide than carbolic acid, and twice as strong as eugenol. (*Pharm. Journ.*, Nov. 30th, 1889.)

A sample of oil distilled from fresh betel leaves in Manila, at the request of Messrs. Schimmel, is described as of a golden yellow colour, possessing a pronounced odour of betelphenol and having a specific gravity of 1·044 at 15° C. The phenol was separated from the oil by the method of Bertram and Gildemeister, and during the purification by distillation at a pressure of 11 mm. it passed over quite regularly between 128° and 129°, a behaviour that pointed to a homogeneous body. By treatment of the phenol with benzoyl chloride a benzoyl compound was obtained that crystallized in scales and melted at 50°. It was evident that this was not a mixture of benzoyl compounds, as the portion that crystallized first had the same melting-point as that which crystallized last; it followed, therefore, that it represented no other phenol than betelphenol. Other constituents occur in this oil only in a small quantity, and of these, to judge from the boiling point, terpenes form only a small fraction. The results of the examination of betel oil up to the present time may therefore be summed up as follows:—

(1) Oil distilled from fresh leaves from Java (Eijkman), contained besides terpenes and other bodies, chavicol and betelphenol.

(2) Oil from dried Siam leaves consisted of sesquiterpene and betelphenol.

(3) Oil distilled from fresh leaves (Java) contained terpenes, betelphenol and a small quantity of another phenol (probably chavicol), the nature of which could not be determined, from want of material (melting point of the benzoyl compound 72°-73°).

(4) Oil from fresh leaves distilled in Manila contained no other phenol than betelphenol.

Betelphenol was contained in all the oils, whether derived from Java, Siam or Manila, or from fresh or dry leaves; it would therefore appear to be a characteristic constituent of betle oil. (*Berichte v. Schimmel & Co.*, Oct. 1891.)

MYRISTICEÆ.

MYRISTICA FRAGRANS, *Houtt.*

Fig.—*Bentl. and Trim.*, *t.* 218; *Reichb. Ic. Exot.*, *t.* 276-277; *Nees, Pl. Med.*, *t.* 133; *Rumph. Herb. Amb.*, *ii.*, *t.* 4. Nutmeg (*Eng.*), Muscade (*Fr.*), Mace (*Eng.*), Macis (*Fr.*).

Hab.—Moluccas. Cultivated in Penang, Malay Island, and Zanzibar. The seeds and arillus.

Vernacular.—Nutmegs—Jaiphal (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Jádikai (*Tam.*), Jaji-kaya (*Tel.*), Jájikayi (*Can.*), Játikka (*Mal.*). Mace—Javitri, Jápatri (*Hind.*), Jádipattiri (*Tam.*), Jápatri (*Can.*, *Tel.*), Játipattiri (*Mal.*), Jotri (*Beng.*), Jáyapatri (*Mar.*), Javantari, Jápatri (*Guz.*).

History, Uses, &c.—Natmegs, in Sanskrit Játi and Játiphala, are mentioned by Susruta, and in the Nighantas bear various synonyms, such as Játi-kosha, Játi-sára, Shálúka, and Majja-sára; they are considered to be hot, digestive, carminative, expectorant and anthelmintic. Mace is called Játi-pattri, and is said to have similar properties. Both of these spices probably became known in India through the Hindu colonists in Java and the Eastern Islands. From India they would appear to have reached Persia and Eastern Europe. The authors of the *Pharmacographia* remark that nutmegs were probably known at Constantinople about the year 540. The Arabs evidently first became acquainted with nutmegs through the Persians, as their name Jouz-bawwa is a corruption of the Persian Gauz-i-buya, "fragrant nut." Masudi, who travelled in the East in A.D. 916—920, discovered that they were obtained

from the Zerbád Islands. Ibn Sina describes both nutmegs and mace (Basbáseh). Edrisi, who wrote in the middle of the 12th century, mentions both nutmegs and mace (Basbáseh) as articles of import into Aden. By the end of the 12th century both of these spices were well known in Continental Europe.

Mir Muhummad Husain says that the Dutch keep the trade in their own hands, but that he has heard that the tree is now cultivated in Sounda in Southern India. Whether he was rightly informed with regard to Sounda, we are unable to say. But that his information was substantially correct, there can be no doubt, as Ainslie tells us that in his time the true nutmeg tree was growing in the Tinnevelly District, and produced pretty good fruit. The tree has also been introduced into Ceylon and Zanzibar, and appears to flourish in the warm moist climates of those islands.

Mahometan doctors describe nutmegs and mace as stimulating, narcotic, digestive, tonic, and aphrodisiac, useful in choleraic diarrhœa, especially when roasted; also in obstructions of the liver and spleen. A paste made with nutmegs is used as an external application in nervous headache, palsy, &c.; applied round the eyes it is thought to strengthen the sight. The expressed oil of nutmegs is imported into India from Banda, and is known as Jawitri-ka-tel (oil of mace). It was formerly exclusively brought into European commerce *viâ* Holland, in oblong cakes having nearly the form of common bricks, but somewhat smaller, and packed in monocotyledonous leaves, commonly called "flag leaves." At the present time much of the oil is manufactured in Europe, and put up in the same shape, but packed in paper. When discoloured and hardened by age, the oil is called "*Banda soap.*" Oil of mace is manufactured by exposing imperfect and broken nutmegs, reduced to a paste and enclosed in a bag, to steam, and then pressing the bag between heated iron plates. The yield is about 20 to 23 per cent. (*Brannt.*) The bark of the tree is astringent. (*Pereira, Mat. Med.*, ii., p. 475.) We have found nutmegs and their

essential oil a valuable adjunct to other drugs in the treatment of diarrhœa and dysentery; they appear to relieve the pain.

Description.—The following excellent description of the nutmeg fruit is taken from the *Pharmacographia* :—" The fruit of *Myristica fragrans* is a pendulous, globose drupe, about 2 inches in diameter, and not unlike a small round pear. It is marked by a furrow which passes round it, and by which at maturity its thick fleshy pericarp splits into two pieces, exhibiting in its interior a single seed, enveloped in a fleshy foliaceous mantle or arillus, of fine crimson hue, which is mace. The dark-brown, shining ovate seed is marked with impressions corresponding to the lobes of the arillus; and on one side, which is of paler hue and slightly flattened, a line indicating the raphe may be observed.

The bony testa does not find its way into European commerce, the so-called nutmeg being merely the kernel or nucleus of the seed. Nutmegs exhibit nearly the form of their outer shell, with a corresponding diminution in size. The London dealers esteem them in proportion to their size, the largest, which are about one inch long by $\frac{8}{10}$ of an inch broad, and four of which will weigh an ounce, fetching the highest price. If not dressed with lime, they are of a greyish-brown, smooth yet coarsely furrowed and veined longitudinally, marked on the flatter side with a shallow groove. A transverse section shows that the inner seed coat (endopleura) penetrates into the albumen in long, narrow brown strips, reaching the centre of the seed, thereby imparting the peculiar marbled appearance familiar in a cut nutmeg. At the base of the albumen, and close to the hilum, is the embryo, formed of a short radicle with cup-shaped cotyledons, whose slit and curled edges penetrate into the albumen. The tissue of the seed can be cut with equal facility in any direction. It is extremely oily, and has a delicious aromatic fragrance, with a spicy rather acrid taste." The expressed oil of nutmeg is of the consistence of tallow, but more friable, orange-coloured, and of a fragrant, spicy taste and odour. It has a sp. gr. of ·990 (*Brannt*).

Microscopic structure.—The brown covering of the nutmeg is formed by the endopleura, which also dips in and forms numerous processes which divide the albumen in every direction; it is composed of soft-walled brown cells, which on the external surface are small and flat, but much larger in the processes already mentioned. The cell-structure of the albumen is loaded with starch and fatty matter, some of which is crystalline.

Herr A. Tschirch states that the aril of *Myristica fragrans* furnishes a good illustration of the presence of amylodextrin as a normal cell-content in the place of starch. It is distinguished from true starch by being stained reddish-brown instead of blue by an aqueous solution of iodine. The grains of amylodextrin are from 2 to 10 μ in diameter, and do not appear to contain even a nucleus of starch. They have usually somewhat the form of a rod, and are often curved or coiled; less often they are roundish or disc-shaped; they do not usually exhibit any evident stratification.

Chemical composition.—Nutmegs contain from 2 to 8 per cent. of volatile oil, 25 to 30 per cent. of fat, starch, protein compounds, &c. The most volatile portion of the oil, after treatment with sodium, was found, by Cloëz, to be a lævogyre hydrocarbon, $C^{10}H^{16}$, having the odour of the nut, and boiling at 165° C. It is the *myristicene* of Gladstone, who named the oxygenated portion *myristicol*, $C^{10}H^{14}O$; this is dextrogyre, boils at 224° C., and does not, like menthol and carvol, yield a crystalline compound with H^2S. The *nutmeg camphor* of John, or *myristicin* of Gmelin, which separates sometimes on standing, was ascertained by Flückiger to be myristic acid. From the expressed oil of nutmeg or nutmeg butter, cold alcohol dissolves about 6 per cent. of volatile oil and 24 per cent. of fat, accompanied by brown-yellow resinous matter, which has not been further examined. The remaining pulverulent white fat is *myristin*, $C^3H^5(C^{14}H^{27}O^2)^3$, which crystallizes from hot alcohol or ether and fuses at 31°C. Heintz found the melting-point of *myristic acid* to be 53·8° C. Schmidt and Rœmer found 3 to 4 per cent. of free myristic acid, with a little stearic acid.

The most important constituent of mace is the volatile oil which is present to the amount of about 8 per cent., but occasionally as much as 17 per cent. may be obtained. (*Pharmacographia.*) Schacht found it to consist mainly of a terpene, $C^{10}H^{16}$, called *macene*, which yields a crystallizable compound with hydrochloric acid gas, and appears to be related to, but, by Koller, considered identical with, the myristicene of oil of nutmeg. The oxygenated portion of the volatile oil is still less known than the terpene. Henry found red fat soluble, and yellow fat insoluble, in alcohol, but the 24·5 per cent. residue obtained by Flückiger (*Pharmacographia*) with boiling ether and drying at 100° C. appeared to have consisted solely of resin and semi-resinified volatile oil. The same author obtained with alcohol 1·04 per cent. of uncrystallizable sugar, and with hot water 1·8 per cent. of a body which turned blue, and after drying reddish-violet, with iodine, and is probably intermediate between starch and mucilage. (*National Disp.*) J. Semmler (*Berichte*, 23, 1803) has isolated, by fractional distillation from mace or rather nutmeg oil, a body possessing the peculiar odour of mace, which he calls *myristicin*, and which has the composition represented by $C^{12}H^{14}O^{3}$. The correctness of the formula was controlled by the preparation of a bromine derivative dibrom-myristicin, $C^{12}H^{14}Br^{2}O^{3}$, which melts at 105° C.

According to Warnecke, powdered nutmegs yield 41·25 per cent. of fat when boiled for two hours in a reflux condenser with benzol, and the dried residual powder gives 3·77 per cent. of ash. Mace yields 1·39 per cent. of ash, and after removal of 30·13 per cent. of fat, 2·74 per cent.

Toxicology.—The narcotic effects of nutmegs noticed by the old Mahometan physicians have been confirmed by Bontius, Rumphius, Lobel, Schmid and Cullen, and more recent experiments upon man and animals agree in showing that they have a narcotic and intoxicating action. In a case related by Cullen, two drachms of powdered nutmegs produced drowsiness, which gradually increased to complete stupor and insensibility. The patient continued for several hours alternately delirious and sleeping, but ultimately recovered.

Commerce.—Value, Re. 1-4-0 to Re. 1-8-0 per lb. The nutmegs imported into India run from 100 to 130 to the pound; the larger seeds never make their appearance in this market. Indeed the native retail dealers prefer small seeds, as they buy by weight and sell by number.

MYRISTICA MALABARICA, *Lamk.*

Fig.—*Bedd. Fl. Sylv., t.* 269; *Rheede, Hort. Mal.* iv., *t.* 5.

Hab.—Concan, Canara, N. Malabar. The seed and arillus.

Vernacular.—Rán-jaiphal, Rámphal (*Mar.*), Panam-palka (*Mal.*). The Mace—Rámpatri (*Mar., Guz.*).

History, Uses, &c.—This drug does not appear to have been known to the older Hindu and Mahometan medical writers, but the following extract from the *Makhzan-el-Adwiya* seems to apply to it. Speaking of true nutmegs, the author says:—'Latterly the English have discovered a kind of nutmeg in Southern India, which is longer than the true nutmeg and softer, but is much inferior to it in oiliness, odour, and medicinal properties." (*Makhzan*, article "*Jous-bawwa.*")

It is the *Nux myristica mas* of Clusius, and the *Panam-palka* of Rheede, who says that the Turkish and Jewish merchants use the nutmegs and mace for adulteration. Rumphius (i.,185) notices it under the name of *Mannetjes-nooten*, and states that it is used by the Javanese and Malays as a remedy for headache and as an aphrodisiac, and is worn round the neck as a protection from boils. It is also used by the Indians in Amboyna, combined with opium and roasted unripe plantains, in dysentery.

According to the editor of the *Pharmacopœia of India*, the seed is used medicinally in the Madras Presidency; it yields, when bruised and subjected to boiling, a considerable quantity of concrete oil, analogous to expressed oil of nutmeg, which is said to be an efficacious application to indolent ulcers, allaying pain and establishing healthy action. An ointment may be made by melting it with sweet oil. The seeds are used for similar purposes in Bombay in the form of a *lép*, and the oil is also extracted.

Recently, the arillus, under the name of '*Bombay mace*,' has made its appearance in the European markets, for the purpose of adulterating true mace. (Confer. *A. Tschirch in Pharmaceut. Zeitung*, 1881, No. 74.) In Bombay it is used as a spice.

Description.—*M. malabarica* bears an oblong, tawny, hairy fruit, 2½ to 3 inches long, with a lucumose arillus, the lobes of which are twisted and folded into a cone at the top, and are longer and thinner than those of true mace. The arillus is of a dark brownish-red colour, and on the inside has adhering to it a thin papery membrance of a light-brown colour. The shell is hard and brittle, and contains an elongated kernel resembling a nutmeg, and from 1¼ to 2 inches long; when cut in two it is seen to have the same ruminated structure, but the odour is fruity, with hardly any aroma. Similarly, the mace is deficient in odour and flavour.

Microscopic structure.—The epidermal cells of the arillus are radially elongated, narrow, and twice as high as those of true mace, which are tangentially elongated; their walls show the cellulose reaction with iodine and sulphuric acid, and with chloride of zinc and iodine swell and turn faintly blue. The oil cells are very numerous, located near the epidermis on both sides, often close together in groups of two or three, oval in shape, somewhat radially elongated, and contain a dark-yellow, usually, resinified oil, frequently also a brownish resin. (*A. Tschirch.*) The external covering of the seed is formed by the compressed cells of the endopleura, and is thicker than that of the true nutmeg; the processes which penetrate the albumen are composed of very large cells loaded with a viscid reddish-brown substance, which has an astringent and somewhat acid taste. The albumen is composed of large cells loaded with starch; some of the cells and their contents are of a reddish-brown colour. There is no crystalline fat visible.

Toxicology.—Rumphius relates that in 1683 a minister of Amboyna was given by his wife three roasted nuts, in mistake for nutmegs, to cure a chronic diarrhœa; in a few hours he became giddy, making strange gestures and talking wildly, nor

did he get any relief until he had taken several cups of tea and been blooded. He then slept profoundly and perspired very freely. On waking, no bad effects remained, and the diarrhœa had ceased. Rumphius remarks that if he had taken three real nutmegs, he would have suffered much more.

Commerce.—Rámpatri is now worth about Rs. 10 per maund of 37½ lbs.; formerly it was much cheaper. The nutmegs fetch Rs. 2 per maund of 37½ lbs. According to Dr. Hefelmann, the adulteration of powdered mace in Germany generally consists in the addition of Bombay mace, or of other vegetable material (leguminous fruits) coloured with turmeric. The presence of the latter is shown by the presence of starch cells which are not present in mace. Bombay mace may be detected by boiling the suspected sample with alcohol and filtering through a white filter; in the case of pure mace, the filter is stained a faint yellow, but in the presence of Bombay mace, the filter, especially the edge, is coloured red. Another more delicate test is to add Goulard's extract to the alcoholic filtrate; with pure mace only a white turbidity is occasioned, but when Bombay mace is present, a red turbidity is obtained. The reaction given by turmeric is similar, but it may be distinguished from that of Bombay mace in the following manner:—A strip of filter paper is saturated with the alcoholic solution, the excess of fluid removed, and the strip drawn through a cold saturated solution of boric acid; when Bombay mace is present, the paper remains unchanged, but in the presence of turmeric it turns orange-brown. If a drop of potassium hydrate solution is now placed on the strip of paper, it causes a blue ring if turmeric is present, and a red ring if the adulterant is Bombay mace.—(*Pharm. Zeit.*, 1891, 122.)

LAURINEÆ.

CINNAMOMUM CAMPHORA, *Nees.*

Fig.—*Bentl. and Trim.*, *t.* 222; *Woodv. Med. Bot.*, *t.* 236; *Nees*, *t.* 130; *Berg. et Sch.*, *t.* 10, *e.*; *Wight Ic.*, *t.* 1818. Camphor (*Eng.*), Camphre (*Fr.*).

Hab.—China, Japan. Camphor and Oil of Camphor.

Vernacular.—Káfúr (*Hind.*), Karppúram, Shúdan (*Tam.*), Karpúram (*Tel.*, *Mal.*), Karpura (*Can.*), Kápúr, Káphúr (*Beng.*), Kápúr (*Mar.*, *Guz.*).

History, Uses, &c.—As has been already mentioned (see article "Dryobalanops"), Sanskrit writers, under the name of Karpura, speak of two kinds of camphor, Pakva and Apakva. It is generally supposed that the former term, which means prepared by the aid of heat, refers to ordinary commercial camphor obtained from the wood of *C. Camphora*. The researches of Flückiger and Hanbury show that the only camphor known in early times was that found in the trunk of *Dryobalanops aromatica*. Early Chinese writers only speak of *C. Camphora* as producing a valuable wood, and we have no information as to the date of the first extraction of camphor from it. Garcia d'Orta, who wrote at Goa about the middle of the sixteen century, was well acquainted with both kinds of camphor, and mentions that the China camphor is the only kind exported to Europe. The medicinal uses to which camphor is put in the East have been already noticed under "Dryobalanops." With the exception of a small quantity of refined camphor imported from Japan, the bulk of the drug used in India is imported in the raw state and resublimed in the country. The process of resublimation is a peculiar one, the object being to get as much interstitial water as possible into the camphor cake. The vessel used is a tinned cylindrical copper drum, one end of which is removable; into this is put 14 parts of crude camphor and 2½ parts of water; the cover is then luted with clay, and the drum being placed upon a small furnace made of clay, is also luted to the top of the furnace. In Bombay four of these furnaces are built together, so that the tops form a square platform. The sublimation is completed in about three hours; during the process the drums are constantly irrigated with cold water. Upon opening them a thin cake of camphor is found lining the sides and top; it is at once removed and thrown into cold water. Camphor sublimed in this way is not stored, but

distributed at once to the shopkeepers before it has time to lose weight by drying. It is sold at the same price as the crude article, the refiner's profit being derived from the introduction of water. Experiments by Clautrian (*Berichte*, xxiv., 2612) have proved that camphor possesses considerable hygroscopic properties which are not shared by thymol. 40 grains of camphor will absorb ·054 gram of water from air saturated with aqueous vapour at 16°C. The absorption of moisture by camphor would appear to be a purely physical phenomenon. Both China and Japan crude camphor is imported into Bombay, but the latter is preferred, as it is cleaner. From Japan is also imported refined camphor in large square cakes an inch and a half thick, with a hole in the centre; it is nearly equal in quality to that refined in Europe. The method of obtaining crude camphor in Japan will be found fully described by H. Oishi in the *Journ. Soc. Chem Ind.*, 1884, p. 353. Camphor is largely used in India in performing the *árti* (आरती), a ceremony performed in adoration of some god by waving, in a circle before the image, a platter containing a five-wicked burning lamp, flour, and incense; the lamp being fed with camphor. The same rite, only substituting a bridegroom for the idol, is called *árta*, and is performed on the arrival of the bridegroom at the house of the bride. In Sanskrit this light is called आरात्रिक (árátrika).

Description.—Crude China camphor is in small dirty-white or brown grains, more or less moist from the presence of water; it arrives in tin-lined boxes which hold one quintal. Crude Japan camphor is also in grains, which often adhere together in masses; it is dry and often quite free from discoloration; sometimes it has a pinkish tinge. It is imported in double butts.

Refined Japan camphor is imported in tin-lined cases, which hold about 90 lbs. Bombay refined camphor is in porous cakes a quarter of an inch thick, and contains much water. Owing to the method of preparation already described, the cakes have no particular form.

Chemical composition.—Camphor, $C^{10}H^{16}O$, by treatment with various reagents, yields a number of interesting products: thus, when repeatedly distilled with chloride of zinc or anhydrous phosphoric acid, it is converted into *Cymene* or *Cymol*, $C^{10}H^{14}$, a body contained in many essential oils, or obtainable therefrom. Camphor, and also camphor oil, when subjected to powerful oxidising agents, absorbs oxygen, passing gradually into crystallized *Camphoric acid*, $C^{10}H^{16}O^{4}$ or $C^{8}H^{14}$ $(COOH)^{2}$, water and carbonic acid being at the same time eliminated. Many essential oils, resins, and gum-resins likewise yield these acids when similarly treated. By means of less energetic oxidizers, camphor may be converted into *Oxy-camphor*, $C^{10}H^{16}O^{2}$, still retaining its original odour and taste. (*Pharmacographia.*) For a full account of the reactions of camphor and its derivatives, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., Vol. I., p. 669. The constituents of camphor oil found up to the present are:—

Boiling point.	Constituent.	Formula.
158°—162°	Pinene.	$C^{10}H^{16}$
170°	Phellandrene.	$C^{10}H^{16}$
176°	Cineol.	$C^{10}H^{18}O$
180°	Dipentine.	$C^{10}H^{16}$
204°	Camphor.	$C^{10}H^{16}O$
215°—218°	Terpineol.	$C^{10}H^{17}OH$
232°	Safrol.	$C^{10}H^{10}O^{2}$
248°	Eugenol.	$C^{10}H^{12}O^{2}$
274°	Sesquiterpene.	$C^{15}H^{24}$

Toxicology.—Instances of poisoning by camphor are rare, and, as far as we are aware, no cases have been reported on by Chemical Examiners in India. In large doses camphor causes excitement and delirium with dilated pupils and sometimes convulsions. The mucous membrane of the stomach may be inflamed, but characteristic lesions appear to be absent.

Commerce.—The crude camphor of commerce is largely manufactured in Central China, Formosa, and Japan, and is exported

from Canton in chests lined with lead or tinned iron weighing about 1 cwt. each, and from the Japan ports in double tubs which contain about the same quantity. The imports into India have an average annual value of seven lacs of rupees. Refined camphor from Europe now forms an important item in these imports, and some years ago refined camphor was also imported from Japan, but lately it has disappeared from the market. The price of camphor in India is now regulated by the European market, and of late has been extremely variable.

CINNAMOMUM CASSIA, *Blume.*

Fig.—*Bentl. and Trim.*, *t.* 223. China cinnamon, Cassia (*Eng.*), Cannelle de Chine (*Fr.*).

Hab.—China. The bark and essential oil.

Vernacular.—Dárchiní (*Hind.*), Dalchini (*Beng.*, *Mar.*, *Guz.*), Lavanga-pattai (*Tam.*, *Tel.*, *Mal.*), Lavanga-patte (*Can.*).

History, Uses, &c.—Cinnamon and Cassia are mentioned as precious odoriferous substances in the Mosaic writings and by Theophrastus and many other writers of antiquity. The Greek names κινναμώμον and κασία or κασσία are derived from the Phœnician, and are the same as those used by the Hebrews. From Galen we learn that these two spices were of a similar nature, but that cassia was inferior to cinnamon. It is impossible to say for certain what these substances were, but it seems probable that κιννᾳμώμον was Chinese cassia, and κασια the bark of the Indian cinnamon trees. Dioscorides describes several varieties of cinnamon and cassia, and we know that several very distinct varieties of Cinnamon bark are still sold in Indian bazars. That Ceylon cinnamon was not known to the ancients appears to be certain, as the sacred books and old records of Ceylon make no mention of that spice, and when the bark began to be collected in the island is unknown. Kazwini in the 13th century is the first writer who mentions it, and it was not cultivated before 1770.

Cassia, under the name of *Kwei*, is mentioned in the earliest Chinese herbal, said to have been written 2700 B.C., and also in the Chinese classics. In the *Hei-yao-pen-tsao*, written in the 8th century, mention is made of *Tien-chu-kwei*. Tien-chu is the ancient name for India. (*Pharmacographia.*)

The bark of several species of cinnamon growing in different parts of India was known to the ancient Hindus as Tvach, "bark," Guda-tvach, "sweet," or "sugar bark," and the trees producing it as Tvak-sára, "having excellent bark," and Tvaksvádvi, "having sweet-bark." The aboriginal tribes still scrape the bark from these trees and use it to season their food, and have probably done so from prehistoric times.

The Arabians, through whose hands most of the cinnamon of the ancients reached Europe, called the spice Kirfat-ed-dársini, or more shortly Kirfah (the bark *par excellence*), and it is curious to observe that the same word in the corrupted form of Kalfah is still the commercial name of Malabar cassia in Bombay. Dársini is the Arabic form of the Persian Dárchini, and signifies "China tree," *dár* being an old Persian name for a tree; it is therefore probable that the Arabs first obtained the spice from the Persians by the overland route from China. The same name is still current in India for Chinese cinnamon, whereas the Indian bark is properly called *Taj*, a word derived from the Sanskrit *Tvach*, although in popular language Dalchini and Taj are loosely applied to any kind of cinnamon. Ibn Sina follows Dioscorides in his description of the different kinds of cinnamon (*dársini*) and cassia (*salikheh*), but later Mahometan writers are better informed, and are evidently well acquainted with the difference between Ceylon cinnamon, China cassia, and Indian cassia. Haji Zein (1368), speaking of Dárchini, says "the best is that which comes from Ceylon"; concerning Salikheh, he says:—"It is what they call cassia (قشيا), and is the bark of a tree called *Salkh*; there are several qualities, the best is of a reddish colour, thick, and a little bitter to the taste, astringent; when broken it has a fracture like China rhubarb, it is in long

folded sticks with a small central hollow like *kirfah*; that which is dark-coloured is bad." Of Kirfah he says, "it has not the sweetness of China cinnamon, and tastes like cloves." In Southern India cassia is called "clove-bark" in several of the vernaculars.

The author of the *Makhzan* remarks:—"From Ceylon to the Dekhan the quality of the cinnamon grown gradually deteriorates, the bark getting thick and mucilaginous."

For the history of cinnamon and cassia in Europe, we would refer our readers to the *Pharmacographia*, where much interesting information will be found.

Cassia and cassia oil imported from China are used medicinally in India in much the the same manner as they are in Europe. Ceylon cinnamon is not an article of commerce in India.

Description.—Chinese cassia arrives in Bombay packed in boxes, which are covered with matting. Each box contains about 60 lbs. The bark is tied up in bundles with strips of bamboo, which weigh about 1 lb. each. The greater portion of each bundle consists of single quills of a light-brown colour, with here and there portions of the external bark still attached; in the centre of the bundle is small collection of fragments of bark and rubbish. Cassia bark is thicker than true cinnamon, but has a similar taste and odour.

Microscopic structure.—Externally the bark is furnished with a suberous layer. Within this is a parenchymatous portion in which may be seen an irregular zone of stony cells. The remainder is mostly composed of liber, in which are situated numerous large cells which contain the essential oil. Laticiferous vessels containing a gummy substance are also present in the parenchyme.

Chinese cassia oil is imported in tins, which contain 12½ catties each; it has a similar odour and colour to oil of cinnamon, but is less agreeable.

Chemical composition.—The authors of the *Pharmacographia* remark: "Cassia bark owes its aromatic properties to an

essential oil, large quantities of which are shipped from Canton. In a chemical point of view, no difference can be pointed out between this oil and that of Ceylon cinnamon. The flavour of cassia oil is somewhat less agreeable, and, as it exists in the less valuable sorts of cassia, decidedly different in aroma from that of cinnamon. We find the sp. gr. of a Chinese cassia oil to be 1·066, and its rotatory power in a column 50 mm. long, only 0·1° to the right, differing consequently in this respect from that of cinnamon oil.

"If thin sections of cassia bark are moistened with a dilute solution of perchloride of iron, the contents of the parenchymatous part of the whole tissue assume a dingy brown colour; in the outer layers the starch granules even are coloured. Tannic matter is consequently one of the chief constituents of the bark; the very cell-walls are also imbued with it. A decoction of the bark is turned blackish-green by a per salt of iron.

"If cassia bark (or Ceylon cinnamon) is exhausted by cold water, the clear liquid becomes turbid on addition of iodine; the same occurs if a concentrated solution of iodide of potassium is added. An abundant precipitate is produced by addition of iodine dissolved in the potassium salt. The colour of iodine then disappears. There is consequently a substance present, which unites with iodine; and, in fact, if to a decoction of cassia or cinnamon, the said solution of iodine is added, it strikes a bright blue coloration, due to starch. But the colour quickly disappears, and becomes permanent only after much of the test has been added. We have not ascertained the nature of the substance that thus modifies the action of iodine; it can hardly be tannic matter, as we have found the reaction to be the same when we used the bark that had been previously repeatedly treated with spirit of wine and then several times with boiling ether.

"The mucilage contained in the gum-cells of the thinner quills of cassia is easily dissolved by cold water, and may be precipitated together with tannin, by neutral acetate of lead, but not by alcohol. In the thicker barks it appears less soluble, merely swelling into a slimy jelly."

Oil of cassia, like oil of cinnamon, consists chiefly of *Cinnamic aldehyde*, $C^6H^5(CH)^2COH$, together with a variable proportion of hydrocarbons. The oil easily absorbs oxygen, becoming thereby contaminated with resin and cinnamic acid, $C^6H^5(CH)^2COOH$. In a sample examined by Messrs. Schimmel, the cinnamic aldehyde amounted to 77·7 per cent., the distillation residue to 5·5 per cent., and the cinnamic acid to 0·7 per cent. After one year's free exposure to light, warmth, and air, the percentage of cinnamic acid in this oil had increased to 8·5, and of distillation residue to 12·6, whilst the cinnamic aldehyde had decreased to 68·5, showing that the most important change in the oil is the conversion of cinnamic aldehyde into cinnamic acid, and a slight increase of resinous matter, to the extent of a few per cents., namely, of one part of the 7 per cent. increase of the residue remaining after distillation at 290° C. This point is of importance, as interested parties have attempted to explain the presence of 30 to 40 per cent. of resin in the commercial oil as formed by a natural process. Messrs. Schimmel have shown that in good samples of oil, such as the *Cheong Loong* and *Yan Loong* brands, we may expect to find from 6 to 8 per cent. of soft distillation residue, and in adulterated oils from 20 to 30 or even 40 per cent. of a hard residue, indicating adulteration with colophony. E. Hirschsohn (*Pharm. Zeitsch. f. Russ.*, 1890) has proposed the following simple test for the oil:—If to a solution of cassia oil in 70 per cent., alcohol in the proportion of 1 : 3 is added, drop by drop, to half its volume, a solution (saturated at the temperature of the room) of lead acetate in alcohol of the same strength, it should show no precipitate, otherwise colophony or a similar resin is present. For further information on the adulteration of this oil, the reader is referred to the *Berichte von Schimmel & Co.*, Oct. 1890.

Commerce.—The annual imports of Chinese cassia range from about 15 to 20 thousand cwts. in alternate years. The greater part of it is shipped from Hong-Kong to Bombay, some goes to Calcutta, and a very small quantity to Madras. The following tables show the imports and re-exports for 1884-85 :—

Imports.

Presidency to which imported.	Quantity.	Value.	Country from which imported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay	12,308	2,01,944	Aden	......	3
Bengal	2,226	41,460	China	13,557	2,24,805
Madras	236	4,940	Straits............	1,212	23,536
Total......	14,769	2,48,344	Total......	14,769	2,48,344

Re-exports.

Presidency from which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay.........	4,675	81,114	Persia	2,785	48,826
Bengal	13	225	Arabia............	980	17,051
Sind	4	55	Turkey in Asia	715	11,956
			Other countries	212	3,561
Total......	4,692	81,394	Total......	4,692	81,394

—(*Dictionary of Econ. Prod. India*, Vol. II., p. 323.)

Chinese cassia fetches in Bombay from 3½ to 4 annas the pound. Malabar cassia about Rs. 5 for the maund of 37½ lbs. Chinese oil sells for about Rs. 2½ per catty.

Taj or **Kalfah,** Indian cassia or cinnamon, is chiefly the product of *C. Tamala,* and *C. iners* and *nitidum,* considered by some botanists to be only coarse forms of *C. zeylanicum,* Breyn. *C. Tamala* is a native of the tropical and subtropical Himalaya from the Indus to Bhotan, and supplies the *Taj* of the N.-W. Provinces, Punjab and Bengal, whilst *C. iners* and *nitidum* supply Southern and Western India. The bark of these trees occurs in flat or slightly quilled pieces, is thicker than the Chinese bark and of a deeper colour; it has a strong cinnamon odour and taste, but is deficient in sweetness. It is now often sent into the market, tied up in bundles, to imitate

China cassia, the outer layer of the bark having been to a great extent removed ; this is probably prepared for exportation as *cassia lignea.* Some trees of *cassia lignea* are cultivated by the Madras Forest Department in the Wynaad. Indian cassia may readily be distinguished from the China bark by its yielding a glairy mucilage when infused in cold water, which gives a ropy precipitate with corrosive sublimate and neutral acetate of lead, but not with alcohol.

No oil is distilled from these barks in India.

Tajpat or **Tamalpatra,** and in Southern India only **Talisha-pattiri,** is the leaf of the species of *Cinnamomum*, already mentioned as yielding *Taj* or Indian cinnamon. The drug is the Tamáli of the Rája Nirghanta, and is considered to be hot and light, and useful for the expulsion of phlegmatic and rheumatic humors; it is prescribed in flatulence and dyspepsia.

Cinnamon leaves are the *Sázaj-i-Hindi* of the Indian Mahometans, and are much used both as a condiment and medicine in India. The author of the *Makhzan* describes them as yellowish, coriaceous, ovate-lanceolate leaves, with five nerves extending from the base to the apex, and says that they are produced by a large tree growing in the mountains of Sylhet, the bark of which is used as cassia. He considers them to be carminative, stimulant, diuretic, diaphoretic, lactagogue and deobstruent.

Description.—The leaves vary a good deal in size, the largest are 6 inches long or more, and 1½ inch broad, oblong, obtuse-pointed, entire, with three principal nerves and two smaller ones which are sometimes quite marginal; the venation between these nerves, which run from base to apex of the leaf, is finely reticulated. The leaves are of an olive-green colour, the upper surface is polished. They have a pleasant odour like a mixture of cloves and cinnamon. Value, Re. 1¼ per 37½ lbs.

According to Professor E. Schmidt (*Chem. Zeit.*, Sept. 26, 1891, p. 1376), the essential oil of cinnamon leaves consists of almost pure eugenol, with a little terpene and cinnamic aldehyde,

while the oil from the root also contains eugenol and terpene, together with much safrol and benzaldehyde. Both of these oils, therefore, differ from the essential oil from the bark, which consists of cinnamic aldehyde and terpene.

Kálá Nágkesar.—Under this name the immature fruit of the trees yielding cassia is imported into Bombay from China and Southern India.

Kálá Nágkesar (known in Europe as cassia buds) consists of a small brown mucronate berry, the size of a grain of millet, enclosed in a 6-partite calyx half an inch long, which is articulated to a slender pedicel; the calyx and pedicel are of the dark-brown colour of the clove, and have a strong cinnamon odour and taste. The properties of the spice would appear to be the same as those of cinnamon. Two kinds are found in the Bombay market, Chinese and Malabar; they are used as a spice by the Mahometans. Mohideen Sheriff says that the native druggists in Madras substitute cassia buds for *Nagkesar-ke-phul,* the flowers of *Mesua ferrea* and *Ochrocarpus longifolius;* the latter drugs being never met with in the bazars. For an account of the use of the Chinese buds as a spice in Europe from the 14th century up to the present time, see *Pharmacographia,* 2nd Ed., p. 533. Hamburg in 1876 imported 1,324 cwts. (*Op. cit.*)

Pishin-puttai (Gum-bark). Several mucilaginous barks are sold and used under this name in Southern India. Mohideen Sheriff refers the Madras drug to *Tetranthera Roxburghii* (see next article). A specimen supplied by Dr. Mootoosawmy from Tanjore had a very pleasant and lasting aroma, and appeared to belong to an arboreous cinnamon. It is used for its mucilaginous and demulcent properties in medicine, and also by Mahomedan perfumers for making incense or flavouring-sticks ("Samburany-vathe") from the powdered bark. We have also received three other drugs of this name from Travancore. One was a thick red fibrous bark like that of a Litsæa, and was an article of trade among sugar and jagary makers on the Western Coast. The second was a lighter coloured bark and quite free from odour and taste; this was recognised as *Kydia*

calycina. The third sample was sent by the Conservator of Forests for Travancore, who supposed it to be from a species of Cordia. It was light coloured, very fibrous and free from odour and taste, and is used in native medicine in the State under its Malyalim name *avi-tholi.* Mucilaginous barks are largely employed in India by arrack makers in regulating the fermentation of toddy and precipitating albuminous matters.

The Tanjore *pishin-puttai* gave no reaction indicating the presence of an alkaloid, but the red bark from Travancore gave marked reactions for *laurotetanine.*

LITSÆA SEBIFERA, *Pers.*

Fig.—*Bot. Reg., t.* 893; *Roxb. Cor. Pl. ii., t.* 147. *Syn.: Tetranthera laurifolia,* Jacq.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Maida-lakri (*Hind.*), Mushaippé-yetti, Maida-lakti (*Tam.*), Naramámidi, Méda (*Tel.*), Kukur-chita (*Beng.*), Méda-lakadi (*Mar.*), Maeda-lakari (*Guz.*).

History, Uses, &c.—We have been unable to trace the history of the use of this bark as a medicine. It is one of the best known and most popular of native drugs, being used internally, on account of its demulcent properties, in diarrhœa and dysentery, and externally as an emollient application to bruises, &c. Maida-lakri, as far as we know, is not mentioned by Sanskrit writers, but from the vernacular names it would appear to be used as a substitute for the *Méda* of the ancient Hindu physicians, one of the *Ashtavarga,* and unknown to the modern Hindus. In Bengal *Asvagandha* is used. In Mahometan works it is briefly noticed under the names of *Maghath-i-Hindi* and *Kilz.* The author of the *Makhzan-el-Adwiya* states that it has the same essential properties as Maghath, being resolvent, astringent, and a nervine tonic useful in paralysis. It would appear then to have been adopted by Mahemetan physicians in India as a substitute for an Arabian drug called Maghath, the botanical source of which is uncertain.

L. sebifera is called *Miri* by the Maratha peasantry, from the resemblance of its globular fruit to a corn of black pepper. The seed is oily and yields a solid white fat. The leaves have a pleasant odour of cinnamon.

Description.—The bark varies in thickness from $\frac{1}{10}$ to $\frac{3}{10}$ of an inch; externally it has several layers of whitish, scabrous, corky tissue, the remaining portion is of a chocolate brown colour. The odour is feebly balsamic; when placed in water it affords a large quantity of bland mucilage, having a faint agreeable aroma. If the bark is old, the aroma disappears, but the mucilaginous qualities remain unimpaired.

The parenchyma, which is chiefly composed of mucilage cells, contains abundance of reddish-brown colouring matter. There is a zone of stony cells, but no distinctive characteristics.

Chemical composition.—This bark, an authentic specimen of which was supplied by Mr. Hollingsworth of the Madras Medical College, gave, on an air-dried sample, 4·6 per cent. of ash, and 14·2 per cent. of alcoholic extract, affording very strong reactions with alkaloidal tests. On separating the alkaloid it was found to agree with the characters of *Laurotetanine*, an alkaloid which has been discovered by M. Greshoff in three species of Litsæa in Java, and in several other plants of the natural order Laurineæ. Laurotetanine is crystalline, and has a strong tetanic action on animals; it is sparingly soluble in ether, more readily in chloroform. It is precipitated by sodium carbonate from solutions of its salts, but readily redissolves in an excess of potash or soda, and is precipitated by the usual alkaloidal reagents. It gives a dark indigo-blue coloration with Erdmann's reagent, a pale rose-red with pure sulphuric acid, and a reddish-brown with nitric acid. A base, which seems to be identical with laurotetanine, is also found in the varieties of *Tetranthera*, *Notophœbe*, *Aperula*, *Actinodaphne* and *Illigera pulchra*. It is also possible that Laurotetanine is the alkaloid discovered in 1886 by Eijkman in *Haasia squarrosa*, Z. et M. (*Meded. uit S'Lands Plantentuin*, vii., p. 77-101.)

Commerce.—The bark is largely collected in the Central Provinces, and comes to market in large half quills from one to two feet in length and two to three inches in diameter. As met with in the retail shops, it is generally broken into small pieces a few inches in length. Value, Rs. 6 per maund of 41 pounds.

Litsæa Stocksii, *Hook. f.*, in Marathi *Pisi*, is a tree of the hilly districts of the Concan and Canara; when in fruit its scarlet berries make it a conspicuous object. A cold infusion of the leaves is mucilaginous, and is used in irritation of the bladder and urethra. The oil of the seeds, *Pisa-taila*, is used as an application to sprains and itch.

Description.—Leaves 4 to 6 inches, penninerved, coriaceous, oblong-lanceolate or oblanceolate, rarely obovoid acute or acuminate, glaucous beneath, greenish above with impressed nerves, petiole ⅜ to ½ inch. Berries apiculate, scarlet, about the size and shape of a small acorn, pulp yellow, seed brown, polished, oblong, testa thin, brittle; kernel oily, white, the cut surface turning red on exposure to the air; taste aromatic, pungent like cubebs; the expressed oil solidifies into a white solid fat; as prepared by the natives it has a reddish colour, due to admixture of resinous matter. The bark and leaves are mucilaginous and not aromatic.

Chemical composition.—The dried and powdered red fruits of this tree yielded to ether 31·6 per cent. of extract consisting mainly of crystalline fats. Petroleum ether separated this extract into a soluble fatty portion, and an insoluble neutral reddish resin. The petroleum ether solution left on evaporation some fatty acids melting at 39° and solidifying at 35°, but which, on crystillization from boiling alcohol and pressure between filtering paper, afforded some purely white crystals melting at 42·5. The fatty acids would appear to consist of lauric acid with a small admixture of oleic acid.

The resin in the fruits was associated with a volatile oil to which the fragrance is due. The alkaloid detected in the

spirituous and the watery extracts of the drug had the reactions of *laurotetanine*. The dried fruits left after ignition 4·77 per cent. of mineral matter.

LAURUS NOBILIS, *Linn.*

Fig.—*Bentl. and Trim., t.* 221. Laurel Bay (*Eng.*), Laurier (*Fr.*).

Hab.—Southern Europe. The berries.

Vernacular.—Hab-el-ghár (*Ind. Bazars*).

History, Uses, &c.—Bay berries were introduced into India by the Mahometans, and are still kept by their druggists in all the larger towns. The Bay or Noble laurel is the Daphne (δαφνη) of Dioscorides, which he describes as hot, demulcent, astringent and stomachic, and recommends the berries in φθίσις and chest affections, and as a stimulant adjunct to wine and ointments. This shrub was held in great esteem by the ancients, who relate that the nymph Daphne, when pursued by Apollo, and on the point of being overtaken by the god, prayed for aid, and was changed into a Bay tree. Prof. Max Müller compares this Greek myth to the Vedic myth of Urvási and Pururavas. The Bay was also used in conjuration; the young girl, who had been forsaken in the second idyl of Theocritus, says:—

> *Δέλφις ἔμ' ἀνίασεν. ἐγω δ' ἐπὶ Δέλφιδι δάφναν*
> *Αἴθω. χ' ὡς αὐτὰ λακεῖ μέγα, καππυρίσασα,*
> *Κὴξαπίνας ἅφθη, κοὐδὲ σποδὸν εἴδομες αὐτᾶς,*
> *Οὕτω τοι καὶ Δέλφις ἐνὶ φλογὶ σάρκ' ἀμαθύνοι.*

The priestesses of Apollo consulted the tree and ate of its leaves before delivering the oracles at Delphi. Hesiod tells us that the muses held branches of it in their hands, and poets are still nominally crowned with a laurel wreath. It was also an emblem of victory, and was used by the Romans in many of their ceremonies.

Oil of Bay berries, the δαφνέλαιον of Dioscorides, is still used in Southern Europe as a nervine stimulant. A medicinal oil is also prepared with the leaves and olive oil, which is much used

in the south of France. The leaves are also considered to be febrifuge, and are used in all European countries for flavouring pastry. In America the dry leaves are largely distilled for the essential oil, which is used for the preparation of Bay Rum, a favorite hair-wash, the disinfectant action of which is due to the eugenol contained in Bay oil. Bayberry oil or expressed laurel oil is obtained from both the fresh and dried berries. The fresh berries are bruised, boiled in water, and pressed in a sack. The expressed oil is then mixed with the decoction, and when cold the oil is found floating on the surface. Dried berries are first exposed to steam, and then subjected to pressure between heated metallic plates. The oil has a butyraceous consistence, and granular appearance. Its colour is greenish, taste bitter and aromatic, with an odour like that of the berries. It melts at 86°—95° F. It is wholly soluble in ether, but alcohol only dissolves green colouring matter and the volatile oil. The solubility in ether affords a test of its purity; if admixed with lard, the ethereal solution is turbid and milky. (*Brannt.*)

Description.—Bay berries are oval or subglobular drupes about ⅜ to ½ an inch long. When dry, they are greenish-black or blackish-brown, slightly wrinkled, and fragile, the integuments, including the reddish-brown endocarp, being thin and brittle. The loose oval seed is easily separated into the two plano-convex brownish cotyledons, which have an aromatic, oily, and bitter taste.

Chemical composition.—The leaves and fruit contain a volatile oil. The volatile oil of Bay berries is pale yellow, sp. gr. 0·91, it congeals at a low temperature, contains oxygen, and is easily soluble in alcohol; it contains hydrocarbons, $C^{10}H^{16}$, boiling at 171° C. and 250° C., and four oxygenated constituents (Staub). Gladstone (1863) had found eugenol, while Blas (1865) could not detect this, but proved the presence of a little lauric acid. Bley (1834) obtained from old berries ·22 per cent. of volatile oil. The seeds contain, according to Bonastre (1824), about 20 per cent.

of fat, 2 per cent. of volatile oil, and 1·5 per cent. of resin. The expressed fat was analysed by A. Staub (1879), who determined, besides volatile oil and chlorophyll, the presence of a little acetic acid and the glycerides of oleic, linoleic, lauric, myristic, palmitic, and stearic acids. *Lauric acid*, $C^{12}H^{24}O^{2}$, discovered by Marsson (1842), has been found in many vegetable and a few animal fats; it melts at 43·5° C., and volatilizes with the vapours of boiling water (Goergey, 1848). Schmidt and Roemer found little free acid in the freshly-expressed oil, but the fruit contained 2 to 3 per cent. of fatty acids. (*National Disp.*)

Cassytha filiformis, *Linn.*, *Rheede, Hort. Mal. vii., t.* 44; A'kásvel (*Mar.*), Amarbeli (*Hind.*), A'kásavalli (*Sans.*), is a common parasite on bushes; it consists of a tangled mass of tough dark-green stems, branched, marked longitudinally with delicate pale green lines, the largest are the size of a crow-quill; the branches are provided with small round suckers, like those of the common dodder. Sections of the stem show a strong fibro-vascular layer and loose central pith. The fruit is globular, of the size of a pea, and surmounted by the remains of the sepals; on removing the outer envelope, which is tough, an inner envelope is exposed, which consists of two layers, the outer cartilaginous, the inner fleshy and lined with white hairs, each containing a delicate spiral filament; within this central cavity is a third delicate membranous envelope covered with hairs, of a similar description, and containing the ovule. The whole plant is used in native practice as an alterative in bilious affections and for piles. In Southern Africa it is said to be used for washing the head, destroying vermin, and making the hair grow. In Senegambia it is employed in urethritis, and in Cochin-China as an antisyphilitic.

Chemical composition.—M. Greshoff has detected an alkaloid in this plant, having the following colour reactions: sulphuric acid faint red, Erdmann's reagent (sulphuric acid mixed with a little nitric acid) blue, nitric acid red-brown,

Fröhde's reagent dirty blue. Dr. Greshoff believes that on a closer investigation of this alkaloid, it will be found to be identical with laurotetanine (described under *Litsæa sebifera.*

THYMELÆACEÆ.

AQUILARIA AGALLOCHA, *Roxb.*

Fig.—*Roxb. & Coleb. in Trans. Linn. Soc. xxi., t.* 21; *Royle Ill., t.* 36, *f.* 1.

Hab.—Eastern Himalaya, Bhotan, Assam, Khasia Mts., Silhet and Tippera Hills, Martaban Hills.

AQUILARIA MALACCENSIS, *Lamk.*

Fig.—*Lamk. Ill., t.* 356; *Cav. Diss. vii., t.* 224; *Rumph. Amb. ii., t.* 10.

Hab.—Malacca, Malay Islands. Eagle or Aloe wood (*Eng.*), Bois de Calambac (*Fr.*).

Vernacular.—Agar, Agaru (*Indian Bazars*).

History, Uses, &c.—The use of this precious wood as a perfume and medicine is of great antiquity. Together with myrrh, cassia, and other products of the East, it is mentioned in the sacred writings of the Jews (*Num.* 24, 6; *Psalm.* 45, 8; *Prov.* 7, 17; *Cantic.* 4, 14) under the name of Ahalot or Ahalim. It is the ἀγάλλοχον of the ancient Greeks, which is described by Dioscorides as a wood brought from India and Arabia. Later writers, from Aëtius' time, call it ξυλάλοη or "aloe wood," the name by which it is still known in Europe. The same substance is the Agaru of the Hindus, the Garu of the Malays, and the Chin-heang of the Chinese. In Sanskrit medical works it bears the synonyms of Rájárha "worthy of a prince," Visvarupa "taking all forms," Krimi-ja "produced by worms," Krimi-jagdha, Anarya-ja "produced in a non-Aryan country," Kanaka "golden," Káliya "black," &c., and is described as hot,

light, and cholagogue; removing diseases of the ear, nose and eyes. In native practice Agar is used as a deobstruent, stimulant, carminative, and tonic; it is said to relieve the pain in gout, and to check vomiting. Susruta directs Aguru, Guggula,* Sarjarasa, † Vacha, ‡ white mustard, Nim leaves and salt to be made into a paste with ghí to form an anodyne fumigation for surgical wounds, called in Sanskrit *Vedanárakshoghnairdhupaih.* As aloe wood bears the Sanskrit name of Anarya-ja, it is probable that it was used by the aborigines of Eastern Asia before it became known to the Hindus, but that at a very early date it was carried overland to Central Asia and Persia, and from thence reached Arabia and Europe.

The early Arab travellers appear to have collected a good deal of information concerning the commerce and sources of supply of the wood.

Yohanna-bin-Serapion mentions four kinds, *Hindi*, *Mandali*, *Sinfi* and *Kamári*, and Ibn Sina in the 10th century has the following account of it:—"The best is called *Mandali* from the more central parts of India; next is the Indian or Hill aloe wood, which has the advantage over Mandali of preserving clothes from lice. Some say that Mandali and Indian aloe wood are the same. One of the best kinds is *Samandúri* from Sofala in India; again there is the *Kamári* and the *Samfi* from the same parts, and there is *Kákuli*, and *Kismúri* which is moist and sweet; and the worst kinds are *Halái*, *Kamtái*, *Mabatái*, *Lawathi*, or *Rabatáthi*. Mandali is the best; then Samandúri, of a grey colour, fat and oily, heavy, without any white streaks, and which burns slowly. Some consider black aloe wood better than grey, and the best black is the Kamári, without white streaks, fat and oily, which burns slowly. In short, the best aloe wood is black, hard, and heavy, sinks in water, is not fibrous when powdered; that which does not sink is bad. The tree is said to be buried to promote the formation of aloe wood." The Arabian travellers give much the

* Resin of Boswellia serrata.
† Resin of Shorea robusta.
‡ Acorus Calamus.

same names to different kinds of the wood. Ibn Batuta speaks of Kamári as soft, like wax. Abu Zaid calls it Kamarúni, and says it is the best kind. Abulfeda states that it comes from the Kamarún Mountains. Kákuli is said to derive its name from Kákaleh in Java. The epithets Máwardi, Saimuri and Jáwi are also applied by some writers to aloe wood. As regards the identification of these localities, we would remark that *Samfi* is probably derived from Champa, a province in Cambodia; *Mandali*, from Mount Mandar or Mandal, south of the modern town of Bhagalpur in Bengal; Kámari or Kamaruni, from Kamarun, the Arab name for Cape Comorin; Saimúri, from Saimur or Samar, an island in the Eastern Archipelago; Halái may possibly be derived from the Hala Mountains between Sind and Beluchistan, as Abu Zaid says that the best aloe wood is brought for sale by Multanis.

Haji Zein-el-Attár (1368) calls aloe wood Ood-el-júj, and in Persian, Ood and Balanjúj. After translating Ibn Sina's article on Ood, he gives his own opinion in the following terms: "The author of this work (*Ikhtiarat-i-badiaa*) says the best is called *Kalambak* (كلمبك), and comes from the port of Jena, which is ten days' sail from Java; it is sold for its weight in gold; you would think it odourless, but when warmed in the hand it has a very sweet persistent odour; when burnt, the odour is uniformly sweet until the wood is consumed. Next is *Mandali* and *Samandúri*, both from Sofala in India, the best of these is of a golden colour and heavy. *Kákuli* is like the Indian, and is generally in large pieces, marked with black and yellow lines; then there is *Kamári*, golden-brown, without white streaks, it comes from Kamarún and Sofala; then *Samfi*, from Samp, it is very hard and sweet; then *Sakáli* and *Afasi*, a moist kind from China; then *Mantai*, *Randi*, *Halai*, and *Lanfi*, all of about equal value. And in Manta there is a tribe who call the wood *Ashbáh*, and it is of two kinds: one of these is in large pieces weighing from 5 to 50 maunds, without much odour, and used for making combs, knife handles, &c.

Mir Muhammad Husain (1770) writes:—"Ood, in Hindi Agar, is the wood of a tree which grows in the Jaintiya hills

near Sylhet, a dependency of the Súbah of Bengal, situated towards the north-east of Bengal Proper. The tree is also found in the islands to the south of Bengal, situated north of the Equator, and in the Chatian islands belonging to the town of Nawaka, near the boundaries of China. The tree is very large, the stem and branches generally crooked, the wood soft. From the wood are manufactured walking sticks, cups, and other vessels; it is liable to decay, and the diseased part then becomes infiltrated with an odoriferous secretion. In order to expedite this change it is often buried in wet ground. Parts which have undergone the change above mentioned become oily, heavy, and black. They are cut out and tested by being thrown into water; those which sink are called *Gharki*, those which partly sink *Nim Gharki*, or *Samáleh-i-aala*, and those which float *Samáleh*; the last kind is much the most common. Gharki is of a black colour, and the other qualities dark and light-brown."

The best kind for medicinal use is Gharki Ood from Sylhet; it should be bitter, odoriferous, oily and a little astringent; other kinds are considered inferior. In most receipts raw Ood (Ood-i-khám) is enjoined to be used to prevent the use of wood from which the oil has been abstracted by crushing and maceration in water, or by crushing and admixture with almonds, which are afterwards expressed.* This precaution is the more necessary as Ood shavings are an article of commerce in India under the name of *Chúra agar*; they are often adulterated with chips of Sandalwood, or Taggar, an odoriferous wood, common in India.

Rumphius describes two kinds of true, and two of false, aloe wood; the first kind of true aloe wood, he says, is called Kilam or Ho-Kilam by the Chinese, and Calambac by the Malays, and is produced by a tree growing in the provinces of Champa and Coinam, and in Cochin-China. This tree has been described by Loureiro under the name of *Aloexylon Agallochum*. The second kind, called *Garo*, is the product of *Aquilaria malaccensis*, Lamk.,

* Nicolaus Myrepsicus prescribes *Agallochum crudum*.

which he figures. This is the Chin-heang of the *Pun-tsaou-kang-muh* or great Chinese Herbal. (See *Hanbury Science Papers*, p. 263.) His two kinds of false aloe wood he attributes to *Michelia Champaca* and *Excœcaria Agallocha.*

Roxburgh and other botanists have examined the Aquilaria in Sylhet, and recently an *Aquilaria* has been ascertained to be the tree which produces aloe wood in the islands of the Mergui Archipelago. Gamble says that "*Akyau* (the Burmese name for aloe wood) is the most important produce of the forests of South Tenasserim and the Mergui Archipelago. It is found in fragments of various shapes and sizes in the centre of the tree, and usually, if not always, where some former injury has been received."

Aloe wood is used throughout the East as an incense and as a perfume, and was formerly used as a medicine in Europe for the same diseases for which it is still prescribed in India.

Collection.—In Sylhet, the collection of aloe wood is a precarious and tedious business; those engaged in it proceed some days' journey into the hilly districts, where they fell any trees they may find, young or old, and then, on the spot, search them for the *Agar*, as the valued wood is called. This is done by chopping off the bark, and into the wood, until they observe dark coloured veins, indicating the proximity of wood of valuable quality, which generally extends but a short distance from the centre of a trunk or branch. In this manner a whole tree is searched through, the collectors carrying away only such pieces as are rich in odoriferous resinous matter. In some districts it is customary to facilitate the extraction of the resinous wood by burying portions of the tree in moist ground, or by allowing the entire tree to remain a length of time after it is cut down, the effect of which is to cause decay in the non-resinous wood, and thus render it easily removable by an iron instrument. Aloe wood is sorted by the collectors into various qualities, the finest of which, called *Gharki*, is worth in Sylhet from 6 to 8 rupees per pound. (*Hanbury Science Papers.*)

Description.—The wood occurs in irregular pieces, which vary in colour from grey to dark-brown, according to the amount of resin which they contain; both light-coloured and dark pieces are marked with longitudinal veins of a darker colour. The best pieces show numerous cavities and sinuses produced by the cutting away of wood less impregnated with resin; they sink in water. When a portion is chewed, it softens between the teeth; the taste is bitter and aromatic; when burnt, it diffuses an agreeable odour.

Mr. J. G. Prebble has kindly furnished us with the following interesting remarks upon the aloe woods of the Bombay market:—"The true Agar woods are imported into Bombay, in boxes holding about 1½ cwt., from Bankok, and usually *viâ* Singapore or Batavia. Some of the Parsee dealers in Chinese silks also import Agar from Hongkong, in small rectangular parcels holding about 1 lb. each, and bearing a yellow label with the name of the packer in the Chinese character. This Agar which I have examined is the Gaguli variety (*A. Agallocha*), and has been carefully dressed, and polished or painted black. One or more false Agars composed of heavy resinous woods are also imported from Singapore. The true Agars vary considerably in the amount of resin they contain; old and decayed samples consist largely of resin. A good specimen yielded to Hanbury* 48 per cent. of matter soluble in rectified spirit. Compact and not apparently very resinous samples of Gaguli and Mawardi Agar, treated successively with petroleum ether, ether, and alcohol, gave:—

	Volatile oil.	Resin soluble in ether.	Resin soluble in alcohol, insoluble in ether.
Gaguli	½ per cent.	13·8 per cent.	9·4 per cent.
Mawardi	1·5 per cent.	11·6 per cent	9·0 per cent.

The volatile oil is of a yellow colour, and possesses the characteristic odour of the woods. It gives a reddish-brown

* *Science Papers*, page 265.

coloration with sulphuric acid. The ether resin is soluble in aqueous solution of potash, with a reddish-brown colour, from which the resin is precipitated by acids. The two true Agars Gaguli and Mawardi are composed of rather thin-walled wood-cells, traversed with numerous one-celled rows of medullary rays which are frequently interrupted by large cellular passages or medullary spots. These structures appear as elongated spots of cellular tissue with their greatest diameter following the periphery of the stem.* In Mawardi Agar the vessels are much larger and more numerous than in Gaguli Agar. The vessels, rays and cellular passages are filled with resin. On comparing sections of the stems, ⅛ inch thick, of herbarium specimens, kindly sent by Dr. King from the Calcutta Herbarium, of *Aquilaria Agallocha* and *A. malaccensis* with the Agars, it was observed that the structure of Gaguli Agar was apparently identical with that of *A. Agallocha*, and I think there is little doubt that this tree is the source of this variety of Agar. Mawardi Agar is also probably derived from *A. malaccensis*. The false Agars have thick-walled wood-cells, less numerous vessels than in the true Agars, and no well-defined medullary spots.

"**Taggar wood** is a heavy, dark-coloured, oily and resinous wood, the botanical origin of which is unknown, imported into Bombay from Zanzibar. It sinks in water, and its aqueous infusion has a yellow colour with a greenish fluorescence From Bombay it is sent to the large cities of Northern India, Delhi, Lucknow, &c., where it is distilled with other ingredients to form some of the compound attars, so much esteemed by the natives.

According to Dr. Royle's Catalogue, Taggar wood was sent from Delhi to the great Exhibition of 1851. Twenty pounds of the ground wood submitted to distillation with water during three consecutive days, with frequent cohobation, yielded six fluid ounces, equivalent to two per cent. of a yellowish oil

* De Bary, *Comparative Anatomy of the Phanerogams and Ferns*, page 492.

which quickly changed to a reddish-brown colour. The oil is neutral, of sp. gr. ·9546, bitter, and with an odour resembling, but distinct from sandal wood oil. It dissolves in all proportions of alcohol, ether, chloroform, benzol and petroleum ether. It dissolves iodine without violent reaction, and yields no characteristic reaction with sulphuric acid, being only darkened in colour. Exposed to the air in a thin layer, it acquires a crimson colour. At a low temperature, by keeping in ice, the oil remains clear and free from any deposit, but becomes very thick and viscid, and develops a strong greenish fluorescence which vanishes or nearly so at a higher temperature, 85° F. The finely powdered wood, treated successively with petroleum ether, ether, and alcohol, yielded to the petroleum ether 8·75 per cent. of a mixture of volatile oil and resin, which deposited on the sides of the evaporating dish a few small tabular crystals. On drying at 110 C., this mixture of oil and resin lost volatile oil equivalent to 5·75 per cent. The ether extracted a resin, 6·4 per cent., soluble in aqueous solution of potash, with a deep reddish-brown colour and greenish fluorescence, in solutions of ammonia and of carbonate of soda. The resin is precipitated from these solutions by acids. Strong sulphuric acid dissolves the resin with a red colour, from which it is precipitated by water in yellowish-brown flocks. It is readily soluble in glacial acetic acid, but no crystals were obtained on the spontaneous evaporation. It is insoluble in benzol and petroleum ether and in boiling alum solution. The resin probably contains an anthraquinone derivative allied to Emodin and Chrysophanic Acid, but I have not yet succeeded in isolating it. Alcohol extracts a resin, 4·12 per cent., insoluble in ether. Taggar wood is valued in Bombay at about Rs. 3 per maund of 28 lbs."

Mazariyun.—The Mezereon of Mahometan physicians is described in their works upon Materia Medica as a leaf.

It is considered by C. Bauhin to be the *Oneorum tricoccon*, and is probably the same as the *Chamælea* of Scribonius, of which he says: "Purgat belle chamælea, quæ herba olivæ folia similia habet: quorum quinque vel sex dare oportet." (*Comp.* 136.)

Apuleius Platonicus has the following notice of it:—"Alii pyros agnen, alii heracleon, alii bdelyram, alii coccon gnidion, Romani citocacium, nonnulli oleaginem, quidam oleastellum vocant." (*De Vir. Herb.*, 26.)

Mír Muhammad Husain says there are three kinds, *viz.*, white with large thin leaves, called *Ashkhís*, yellow with yellowish thick leaves, smaller than those of the olive, called in Persian *Haft-barg* and *Musht-rú*, and black with black leaves! The white is to be preferred as the least acrid; but even the leaves of this kind require to be soaked for forty-eight hours in vinegar, which should be several times changed, to make them fit for medicinal use. Having been thus prepared, they are to be washed and dried, and pounded with almond oil. This preparation may then be given in combination with purgatives, bitters and aromatics, in dropsy or in such cases as are benefited by hydrogogue and drastic cathartics, to the extent of 24 grains. Mulla Ahmad Nabtí, in his *Tarikh-el-hukama*, tells a story of a dropsical patient, who was cured by eating locusts which had been feeding upon Mezereon leaves; they acted as a hydrogogue cathartic.

Lasiosiphon eriocephalus, *Dcne.*, *Wight Ic.*, *tt.* 1859-60; *Jacq. Voy. Bot.*, *t.* 150, a native of the Deccan Peninsula and Ceylon, is a shrub with leaves like the willow, and terminal heads of flowers, surrounded by an involucre of oblong, rather hoary leaflets. It is common on the hills of Western India, and the bark is a powerful vesicant, which has not, as far as we are aware, been mentioned in native medical works. The peasantry are, however, acquainted with its properties, and when they have a lean ox or cow to take to market, rub the skin with a decoction of the bark, which causes swelling and an appearance of plumpness, which disappears in a few days much to the discomfiture of the purchaser.

Dr. J. Y. Smith, in his *Matheran Hill, its People, Plants and Animals* (p. 35), says "the *Rametha* bushes are often seen stripped of their bark, which is used for poisoning fish."

The bark consists of an outer suberous portion which is of a light-brown colour and divided by numerous transverse and longitudinal fissures, so that it can be easily separated, and of an inner layer which is white, tough, and silky like Mezereon. The wood-cells are easily separated and form pretty microscopic objects, as they are beautifully transparent. The taste is acrid.

Chemical composition.—The fresh bark was beaten into a paste in a mortar, and the mass divided and placed in two bottles, one containing ether and the other spirit of wine; they were both shaken occasionally and the mixture allowed to macerate for 24 hours. The ether extract was filtered off and evaporated at a very low temperature until a thick, green, greasy substance was left. This was washed with warm water and a small piece placed upon the skin of the arm and spread so as to cover a space the size of a rupee. In about two hours irritation of the skin was produced, and, on removing the covering of the arm, it was found that several small blisters had formed under the extract and extending beyond it. The alcoholic tincture was then removed by filteration and carefully evaporated at a gentle heat. The residue contained very little of the green-coloured resinous matter, but a large quantity of saccharine substance, which was non-crystalline. This extract was applied to the skin as in the previous experiment, but the application was followed by only a slight reddening due to the small amount of resin in the dried extract. The resin appears to be the source of the vesicating principle of the bark. It has an acid reaction in neutral solvents, is soluble in ammonia with a yellowish-brown colour, and is associated in the ethereal extract with a fatty base which facilitates its use as a blistering agent.

The roots of **Daphne oleoides**, *Schreb.*, *Royle Ill.*, *t.* 81, are used in Afghanistan as a purgative. Aitchison (*Flora of Kuram Valley*) says: "Camels will not eat this shrub except when very hungry. It is poisonous, producing violent diarrhœa. I feel certain that much of the mortality of camels in the Kuram Division was due to the prevalence of this shrub."

LORANTHACEÆ.

VISCUM ALBUM, *Linn.*

Fig.—*Eng. Bot. xxi., t.* 1470; *Woodv. Med. Bot.*, suppl., *t.* 270. White Mistletoe (*Eng.*), Gui (*Fr.*).

Hab.—Temperate Himalaya. Westward to the Atlantic. The berries.

Vernacular.—Kismish-kawali (*Ind. Bazars*).

History, Uses, &c.—Mistletoe is the ἰξὸς of Theophrastus and Dioscorides, and was considered by the ancients to have discutient properties. It was applied to disperse tumors and to mature abscesses, and was given internally in enlargement of the spleen. Matthiolus and Paracelsus recommend it in epilepsy, and Kölderer, Cartheusar, Colbatch, Löseke, Van Swieten and others have stated that they found it beneficial not only in this disease, but in other convulsive affections. This plant was formerly held to be sacred in Europe, and in ancient Britain it was cut with a golden sickle by a Druid in white robes, amid the sacrifice of victims and the fasting of devotees. Thus obtained, the *Gwid* was considered a heal-all, a charm against disasters, and the emblem of fertility. As such it was a special object of worship with the ancient Britons, who called it *uchelfa*, a high place, *uchellawr*, the most exalted, *uchelwydd*, the lofty shrub, *awyrbren*, the ethereal tree, *prenpuraur*, the tree of pure gold, &c.—names still surviving in the Welsh language.

Pliny (xvi., 93, 94, 95) describes the Viscum, and the method of making birdlime from it; he also notices the superstitions held concerning it by the Gauls, and its worship on the fifth day of the moon, the day which is the beginning of their months and years. A festival in honour of the mistletoe called *Guilanleu* or *Guilanneuf* (gui de l'an neuf) was held in France as late as the 16th century, and in England the plant still hangs in the hall at Christmas.

The dried berries sold in the bazars as *Kismish-kawali*, or more correctly *Kismish-i-káwaliyán*, are also called Muizak-i-asli, and in Arabic, Dibk.

Káwali or Kauli is the name of a gipsy tribe in Persia. Baron C. A. de Bode, in his *Travels in Luristan and Arabistan* (Vol. II., p. 100), mentions his being shown in the forests of the Zagros mountains, on the road from Kirmanshah to Baghdad, a fruit called by the natives Angur-i-Kauli, or grapes of the Kauli, which grow on the Mázu or gall-tree (oak), of a yellowish transparent colour, sometimes used as glue.

The hakím Dáwúd says of Dibk (in a passage which is imperfect in the *Táj el Arûs*) "it is found upon the tree in like manner as lichen (الشيبة), but is a berry, like the chickpea (حمص) in roundness; . . . . the best thereof is the smooth, soft, with much moisture, inclining, in its exterior, to greenness, and it is mostly found upon the oak; when it is cooked with honey and دبس (juice of fresh dates, &c.) . . . . and drawn out into longish strings, and put upon trees, the birds become caught by it." (*Madd el Kámús.*) The author of the *Makhzan-el-Adwiya* has the following account of it:—"A berry smaller than the seed of *Cicer arietinum*, green when fresh, but when dry shrivelled and of a brown colour, the contents are moist and viscid, the seeds about the size of poppy-seeds. The plant is parasitic upon the pear and other trees, and consists of several branches, the leaves are like those of the pomegranate, and of a pale green. Properties resolvent and laxative, a solvent of corrupt humors which it withdraws from the system. When steeped in hot water, strained, and beaten up with the kernels of the walnut or castor oil (which is the usual form of administration), it clears the system of adust bile and phlegm, removes obstructions, and is a remedy for lumbago, piles, &c. Applied externally it promotes the suppuration, or causes the dispersion of tumors or enlargements. Sportsmen use it as birdlime, and dyers as a mordant for crimson."

Of recent years, mistleloe has again attracted attention as a medicine. Dr. W. H. Long (*New Remedies*, 1878, p. 112) after,

ten years' experience of it as an oxytocic, arrived at the conclusion that it is superior to ergot. He used it also in the forms of infusion, tincture, decoction and fluid extract in many cases of menorrhagia and post-partum hæmorrhage with gratifying results. He conceived that it incited the natural, rather than the tonic, contraction of the uterus. A physician in South Carolina refers to three cases of abortion in negroes produced by this plant. (*Med. Rec.*, xvii., 276; *Stillé and Maisch., Nat. Disp.*, 1884, p. 1617.) Dr. R. Park speaks of a tincture of *Viscum album* as a valuable substitute for Digitalis; the ecbolic action of the plant, he says, is more energetic than that of ergot. Dose, 10—60 grains.

Description.—The dried berries are about ⅓ of an inch in diameter, soft, brown, and shrivelled; they contain a small seed about the size of a poppy-seed. When crushed they are very sticky.

Chemical composition.—M. Pavlevsky (*Bull. Soc. Chim.* (2), xxxiv., 348) has obtained from the leaves of *V. album* a crystallizable acid corresponding to the formula CH^4O^4 or (CH^3O^3) HO. It forms large prisms insoluble in alcohol and ether, slightly soluble in water, and fusing at 101—103°C. It is obtained by boiling the leaves with water acidulated with nitric acid, and allowing the decoction to cool. The silver salt of this acid is explosive. (*Year-Book of Pharm.*, 1881, p. 63.)

The berries contain a substance which has been named *Viscin* by Reinsch, who obtained it from birdlime by digesting it with 90 per cent. alcohol as long as it coloured that liquid yellow, after which it was boiled repeatedly with alcohol to remove wax. The remaining yellowish-brown mass, when treated five or six times with ether, gave up viscin, whilst *viscaoutchin* and woody fibre remained undissolved. The ethereal solution was then evaporated, and the viscid yellow mass thus obtained kneaded with alcohol so long as it gave off colouring matter. It was then kneaded under water, and heated to 120°, without access of air, until the whole of the water was expelled. Viscin is a clear transparent mass, of the consistence of honey

at ordinary temperatures, and capable of being drawn out into long threads; fluid at 100°, like oil of almonds; sp. gr. 1. It produces a greasy stain on paper, is nearly inodorous and tasteless, and has an acid reaction. Formula $C^{40}H^{48}O^{16}$. Viscaoutchin remains behind, together with woody fibre, after the extraction of viscin by ether as above, and is taken up by oil of turpentine. After distilling off the turpentine, the yellowish mass is dissolved in ether, in which it has now become soluble; the ethereal solution is evaporated, and the residue is washed with alcohol and water, and dried at 120°. At ordinary temperatures it is viscid, and resembles vegetable wax; at 120° it is of the consistence of olive oil. It is very elastic, and may be drawn out into long threads; sp. gr. 0·978. It is tasteless, of faint odour and neutral reaction. Formula $C^{40}H^{37}O^{5}$. (*Gmelin*, xvii., p. 352.)

Viscum et **Loranthus**, sp. var. In the *Pharmacopœia or India*, the leaves of a Viscum, doubtfully referred to *V. monoicum* (Kuchila ke molung), growing on Nux Vomica trees in the neighbourhood of Cuttack, are stated to possess poisonous properties similar to those of the tree on which the plant grows. The subject was investigated in 1837 by Sir W. O'Shaughnessy, who is said to have detected in the powdered leaves the presence of strychnine and brucine: and the leaves were for a time used by Dr. Duncan Stewart and others as a substitute for Nux Vomica. A case of what is stated to have been fatal poisoning by the leaves is mentioned by Norman Chevers in his work on *Indian Medical Jurisprudence.* The symptoms were those of strychnia poisoning. In 1861 Mr. Leon Souberain (*Pharm. Journ.*, p. 568) published an account of a poisonous species of Loranthus found on the Nilgiris, growing on Nux Vomica trees, and known to the natives as *Poulourivi.*

In Pudukota, a decoction of a species of Loranthus called *Pillooroovi* or *Kooroonthoo,* probably the same plant, is applied to skin diseases to relieve itching.

Under the name of *Bandákpushp,* the flowers of *Loranthus longiflorus,* Desrouss., *Rheede, Hort. Mal., x., t.* 4, have been sent

to us from Poona as having a reputation among the Hindus as a remedy in consumption, asthma, and mania; they are astringent.

Dr. Buchanan-Hamilton, when in Mysore, was shown the *Loranthus falcatus*, Linn. ('Wotu,' *Canarese*), the bark of which was used by the poorer natives in place of betel-nut; with quicklime it tinges the saliva and mouth of a fine red, brighter even than that communicated by the Areca.

In Travancore, the Loranthaceous parasites on the Nux Vomica are called *Kanjiram-eitthal* in Malayalim, and are used in medicine by the natives, but when the parasites are scarce, the young leaves of the Nux Vomica tree are used as a substitute.

A contribution by M. A. Chatin to the Paris Academy of Sciences entirely contradicts the statement we have extracted from the *Pharmacopœia of India*, and the belief of the natives that these parasites partake of the nature of the plants upon which they grow; so that the old ideas concerning the non-elaboration of sap by parasitic plants will have to be abandoned.

M. Chatin finds that the tannin of the mistletoe is not identical with that of the oak on which it grows, but gives a green colour and not a blue-black with iron salts; that the *Loranthus*, which grows on *Strychnos Nux Vomica*, does not, as has been asserted, contain a trace of either strychnine or brucine, and that the *Balanophora* parasitic on *Cinchona Calisaya* does not contain any of the alkaloids of cinchona barks. The *Loranthus* growing on orange trees never partakes of the yellow colour of the wood of its host plant, nor does the *Orobanche* of the hemp possess the odour of the latter; while *Hydnora africana*, used as food in South Africa by the Hottentots, grows on an acrid and even vesicating *Euphorbia*. It is evident, therefore, that the sap absorbed from the host plant must be modified by the parasite to form its own peculiar products. (*Pharm. Journ.*, May 2nd, 1891.)

The Forest Officer of Ganjam, a district where the Strychnos grows so plentifully, sent to one of us a specimen of a species of Viscum taken from these trees, which was identified as

V. articulatum. The sample was a small one, but it was sufficient to determine by analysis that the trace of alkaloid present was neither strychnine nor brucine. The leaves contained a peculiar tannic acid, giving a green precipitate with ferric salts, and a resin soluble in ether and alcohol, striking a blood-red colour with strong sulphuric acid. The chemical constituents of the leaves of the parasite were altogether different to those of the leaves of the Nux Vomica tree.

SANTALACEÆ.

SANTALUM ALBUM, *Linn.*

Fig.—*Bedd. Fl. Sylv., t.* 256; *Hayne, Arnz. Gewachs. x., t.* 1; *Bentl. and Trim., t.* 292; *Rumph. Amb. ii., t.* 11. Sandalwood (*Eng.*), Santal blanc (*Fr.*).

Hab.—Deccan Peninsula. The wood and essential oil.

Vernacular.—Chandan, Sufed-chandan (*Hind.*), Sandanakkattai (*Tam.*), Gandhapu-chekka (*Tel.*), Chandana-mutti (*Mal.*), Gandhada-chekke (*Can.*), Chandon, Sada-chandon (*Beng.*), Chandana, Sukhada (*Guz.*), Chandana, Gandha-che-khor (*Mar.*).

History, Uses, &c.—Sanskrit writers make two kinds of Chandana: the darker, heartwood, they call *Pitachandana*, or yellow Sandal; and the lighter wood, *Srikhanda*, or white Sandal. Chandana is mentioned in the *Nirukta*, or writings of Yaska, the oldest Vedic commentary extant, said to be written not later than the 5th century B.C. It is also referred to in the ancient epic poems of the Hindus, the *Ramayana* and *Mahabharata*.

According to the *Kathásaritságara*, it is one of the trees of the Buddhic paradise, and the chariot of the sun is made of its wood bound with gold.

Sanskrit medical writers describe sandalwood as bitter, cooling, astringent, and useful in bilious fever and heat of body;

a paste of the wood is directed to be applied externally to inflammatory affections of the skin, and is a domestic remedy for all kinds of pains and aches. Under the name of *gandh* (perfume), it is largely used in Hindu ceremonial, being smeared upon idols and upon the foreheads of their worshippers. The wood is chiefly consumed at the *chita* or funeral pile, even comparatively poor people spending as much as fifty rupees upon it. The Parsees also use it at their funeral ceremonies. Mahometan medical writers, commencing with Masih and Ibn Sina, call the wood Sandal, and follow the Hindus in distinguishing the dark-coloured portion from the light. The author of the *Makhzan* describes it as cold and dry, cardiacal, tonic, astringent, alexipharmic, antaphrodisiac, a resolvent of inflammatory swellings, &c. He recommends an emulsion in bilious fever, on account of its cooling and protective influence over the heart, brain, stomach, &c. As an external application a paste made with rosewater and camphor, or with sarcocolla and white of egg, may be applied to relieve headache, or to any kind of inflammatory swelling or skin affection. Sometimes the paste is made with the juices of herbs, such as purslane, nightshade, &c. Ainslie states that in Southern India sandalwood given with milk is regarded as a valuable remedy in gonorrhœa. Rumphius (ii., p. 42) mentions a similar use of it at Amboyna. In the Concan sandalwood oil with cardamoms and bamboo manna is given in gonorrhœa, and mixed with limejuice and camphor it is used as a cooling application to eruptions, &c. A conserve of sandalwood is also made by boiling the wood cut in small pieces in bangar-khár (impure carbonate of potash) and water (4 seers sandal, half a seer bangar-khár, and 32 seers water), until it is quite soft. It is then preserved in a thick syrup. Sandalwood was known to the Greeks from the time of Alexander. Arrian mentions ξύλα σαγαλίνα among the Indian imports into Oman in the Persian Gulf. Constantinus Africanus, a physician of the School of Salerno, appears to have been the first to use it medicinally in Europe. In the *Pharmacopœia of India*, Dr. Æ. Ross is stated to have subjected the wood to trial, and found that whilst its effects as a stimulant were very slight, its

secondary effect was that of a sedative on the circulation. In remittent fevers in which it was administered, it acted as a diaphoretic, diminishing at the same time the rapidity rather than the violence of the heart's action. Dr. Henderson, of Glasgow, and, in France, Drs. Panas, Gubler and Simmonet, have directed the attention of European physicians to the valuable properties of the oil as remedy for gonorrhœa, in doses of from 30 to 40 minims three times a day, and there is now some demand for it in India for this purpose.

Dr. Henderson asserts that he always found it inoffensive, even in strong doses; that at the expiration of forty-eight hours complete relief is effected; besides, it has the important qualification of pleasing the patient and being agreeable to the stomach; it is superior to copaiba and cubebs, succeeding where the latter have failed, and with a delicate subject it is to be highly valued as a remedy uniting a real stomachic to a great specific action, and that, in short, during the last five years, he is indebted to it for a great number of successful cases. (*Medical Times and Gaz.*, June 1865.) In a communication to the Paris Chirurgical Society, Dr. Panas (1865) equally advocated its use. Oleum Santali has also been prescribed in chronic catarrh of the bladder, where it performs the same offices as oil of turpentine, without its injurious effect on the kidneys and alimentary canal. In all cases it is best administered in the form of Midy's Capsules, ten to twelve of which may be given daily at first, divided into three doses, each of which may be taken a quarter of an hour before meals; the number of capsules taken daily may be gradually increased to 24, but as soon as the discharge becomes serous, the dose should be gradually diminished. M. C. Méhu has observed that after the internal administration of oil of sandalwood, a resinous substance is found in the urine having the odour of the wood, which appears to be kept in solution by phosphate of soda, and which has the properties of a very weak acid. This resinous substance can only be obtained in very small quantities by shaking the urine with ether; to obtain it in larger quantity, an acid must be used (phosphoric or tartaric), which makes the urine turbid from separation of the resinous matter. If the urine

is now shaken with ether, and the ether evaporated, the resinous matter is obtained of a light-brown colour, and having the odour of sandalwood. This substance in contact with concentrated sulphuric acid affords the same yellow-brown and red colours as pure oil of sandalwood. M. Méhu has also observed that the pure sandal oil does not communicate a violet odour to the urine, as is the case when the oil is adulterated with copaiba and turpentine. (*Journ. de Pharm. et de Chim.*, Sept. 1st, 1886.) The fact of a resin being precipitated by acids from the urine in cases in which sandalwood oil has been administered, has therefore to be remembered in testing for albumen with nitric acid.

Description.—Sandalwood logs are about a yard in length and 5 to 6 inches in diameter; they are stripped of the bark and a portion of the sapwood. Andreas Petersen of Copenhagen, who made in 1886 a very careful investigation of the wood, says:—"It is very homogeneous, rather hard and ponderous, although it does not sink in water. The heartwood is pale reddish, with darker reddish-brown and brighter yellowish concentric zones, which, when examined under the microscope, prove to be annual rings. In the inner part of the wood they are sometimes very wide, measuring, for instance, as much as seven millimetres. Possibly, therefore, they do not correspond to one year's growth, but to that of a longer period.

"The transverse section, examined by means of a lens, displays the numerous narrow medullary rays; the vessels are partly empty, partly loaded with yellow resin. In the bright yellowish sapwood both vessels and medullary rays are less distinct. The sapwood is scentless, whereas the heartwood, especially when freshly cut, is in a high degree possessed of the very agreeable and remarkably persistent odour of sandal oil.

"The miscroscope shows the prevailing part of the tissue of the wood to be made up of ligneous fibres (libriform), the thick walls of which are marked with small annular pits (behöfte Tüpfel). The woody tissue is traversed by medullary rays consisting of

one or two rows of somewhat irregular cells. On a transverse section, the distance of the medullary rays from each other is very different. According to the size and position of the vessels, the medullary rays are somewhat undulated. Most of the vessels are very large, the largest as much as 89 mkm. in diameter. They are very regularly distributed, either isolated, or in groups of two or three, very seldom more. Their walls are very thick, being marked with numerous annular pits, communicating with those of the surrounding cells. There is also to be met with in the wood, parenchymatous tissue to some extent, which is made up either of isolated cells or of short tangential or oblique rays of two to five cells; these parenchymatous layers very seldom run from one medullary ray to another. Crystals of oxalate of calcium are also found; and in longitudinal sections they are seen to be enclosed in long ducts, containing each 10—15 crystals. As to the concentric zones of darker and brighter tint, as mentioned above, the vessels of the latter zones are much smaller and less numerous than those of the dark ones; the libriform cells likewise show the same difference, although less distinctly. Thus the dark zones in all probability represent the wood built up in spring. The vessels have an average diameter of 74 mkm., those of the vessels in the other rings being only 47 mkm.

"The darker colour is due partly to the actual cell-walls, partly to the resin contained in numerous vessels. On the whole, the concentric markings or zones are more distinct to the naked eye than under the microscope. On a vertical section the medullary rays are seen to be built up of usually less than eighteen layers, each consisting of two or three rows of cells. The position of the medullary rays and pits does not allow this wood to be classed among the woods which were described by Höhnel as showing the remarkably regular arrangement of layers or series like stories, which he termed a 'stockwerkähnliche' structure. If these slices of the wood are boiled for some minutes with nitric acid (1·185), a little chlorate of potassium being added, the single cells are easily isolated. The libriform cells are then distinctly seen to exhibit the typic form alluded to above, a few

of them reminding one extremely of the fibres, of which the pinewood is made up. I have also noticed intermediate fibres, marked with both true annular and laterally extended pits (Hoftüpfel and Spalttüpfel). The vessels are short, somewhat obliquely truncated, and perforated with a great annular hole, the ends of the vessels being more or less pointed.

"Only the heartwood is valuable, the sapwood and branches being not used. I failed, in fact, in demonstrating the presence of oil in the sapwood, the tissue of which is nearly colourless, and exhibits no contents at all in its cells. In the heartwood, on the contrary, the cell-walls are very rich in yellow colouring matter. The parenchymatous part of the wood, the medullary rays and numerous vessels are loaded with a yellow-brownish resinous matter. Thin slices, examined under water or glycerine, display a great many smaller and larger drops, soluble in alcohol and reducing osmic acid (1 part dissolved in 100 parts of water); no doubt they are drops of essential oil. These drops, flowing out of the ducts, on thin sections are seen most abounding along the primary membranes of the cells and in their pits. But if rather thick sections are treated with osmic acid, the woody parenchyme and the medullary rays also assume a black colour, due to reduced osmium. If, on the contrary, the sections, before being treated with osmic acid, have been well washed with alcohol, the just mentioned parenchyme is not at all or but extremely faintly blackened. The cells under notice contain no tannic matter, as shown by means of bichromate of potassium and chloride of iron, the reduction of the osmic acid is consequently not due to tannic matter. Small pieces of the heartwood were further treated for some days with a solution of osmic acid, then extracted by means of alcohol and dried. When sections were made from these pieces, I ascertained that nearly all the parenchymatous parts had assumed a black colour. Sometimes also the libriform cells contain a small amount of oil, but the experiments just mentioned prove the *parenchymatous tissue of the wood to be the principal seat of the essential oil.* When treated with a mixture of equal parts of

glycerine and solution of potash (5 per cent.), oil drops are also distinctly seen in the parenchyme. I ascertained that there is no corky membrane in the walls of these cells, like that occurring in many other cases. From a physiological point of view, the absence of corky walls of the cells of the heartwood might be expected." (*Pharm. Journ.* (3), xvi., 757.)

Chemical composition.—The wood treated with boiling alcohol yields about 7 per cent. of a blackish extract, from which a tannate is precipitated by alcoholic solution of acetate of lead. Decomposed by sulphuretted hydrogen, the tannate yields a tannic acid having but little colour, and striking a greenish hue with a ferric salt. The extract also contains a dark resin. (*Pharmacographia.*) The most interesting constituent of sandalwood is the fragrant essential oil. It is a yellowish, remarkably thick liquid, having a high specific gravity (usually more than 0·960); and is a mixture of hydrocarbons and oxygenated oils, boiling at a very high temperature. The specific gravity of a pure sample of oil distilled at Hunsur from the roots was 0·9745 at 15°·5. M. Chapoteaut (*Bull. Soc. Chim.*, xxxiv., 303) has shown that it is composed of two oils, one boiling at 300° and the other at 310°, and that the composition of the oil boiling at 300° is $C^{15}H^{24}O$, and of the oil boiling at 310° $C^{15}H^{26}O$. This chemist has been able to obtain with the latter oil a series of ethers under the influence of the different acids he brought to act upon it, and has announced the important fact that the oil $C^{15}H^{26}O$ is an alcohol, the aldehyde of which is the oil $C^{15}H^{24}O$. Phosphoric anhydride absorbs water from both, converting them into hydrocarbons of the formulæ $C^{15}H^{22}$ and $C^{15}H^{24}$, respectively. By the Indian process only 2·5 per cent. of oil is obtained from the wood, but the powerful apparatus of Messrs. Schimmel & Co. of Leipzig affords as much as 5 per cent.

Collection and Commerce.—Mr. C. E. M. Russell, Superintendent of Forests in Mysore, in a Report upon sandalwood (1889), says:—" Sandalwood is the most important source of Forest

revenue in Mysore. It is a monopoly of the Mysore Government, and, except by Government Agency, no sandal tree can be uprooted or cut down even upon land which is private property. The only exceptions are the Jahgirdar of Yelandur and the Guru of the Sringeri Matt, who are permitted to cut and dispose of the sandalwood of their own Jahgirs. The tree is plentiful in the Mysore country, and occurs also, but in far less quantities, in those portions of the Madras territory which border upon Mysore; for practical purposes, however, Mysore may be said to almost hold the monopoly of the sandal supply. It is a somewhat delicate tree, is killed outright by fire, is very impatient of injuries to the roots and bark, and requires shade and protection while young. The value of the wood is dependent upon a volatile oil which is contained in the heartwood only, and in order that this oil may be developed in the highest possible degree, it is necessary that the growth of the tree should be slow, consequently sandalwood grown in arid situations on poor stony soil is, though small, of far more value than is that produced by large well-grown trees growing in moist situations and in richer soil. The maturation period of the sandal tree is variously stated at from 40 to 60 years. Sandalwood is not eaten by white ants, and its contained oil preserves it from decay in a remarkable degree, of which the present collection of old sandal roots left in the ground for many years past is a conclusive proof. In former times it was the custom not to uproot, but to fell, sandal trees, whereas for many years past the trees have been uprooted, and the roots, which contain a higher percentage of oil than the wood, are in great demand and command high prices.

"Even in periods of depression of the sandal market, a fair demand for roots has always been noticeable. The method of preparation is as follows :—

"The trees having been uprooted are roughly deprived of bark and of some of the sapwood on the spot, and are then carted into the nearest of the sandal Kothis, of which nine exist in the Mysore Province.

" The distribution of the various sandal Kothis and their names are :—

District.	Number of Kothis.	Names.
Mysore...........................	2	Hunsur and Seringapatam.
Bangalore........................	1	Bangalore.
Shimoga	4	Shimoga,
		Tirthahalli,
		Anantapur, and
		Shikarpur.
Hassan...........................	1	Hassan.
Kadur	1	Chikmagalur.

" On arrival at the Kothis, the trunks are sawn off above the roots, cut into lengths, all the white wood removed, the billets adzed and subsequently planed and smoothed, the roots adzed and freed of all adhering bark, mud, and white wood, and the various products—billets, chips, small pieces, hollow wood, saw powder, &c.—collected and classified according to the classes represented by the specimens forming the sandal trophy. About the months of November and December auction-sales of the various classes are held in all the Kothis of the Province, and are so arranged, as regards the dates fixed for holding the same, that purchasers may, if they choose, attend the sales in Shimoga, Kadur and Hassan, and yet be in time for those in Mysore and in Bangalore.

"*Range and Yield of, and Revenue derived from, Sandalwood.*— The range, yield of wood, and the revenue derived therefrom can conveniently be shown in tabular form. The statements below contain the figures for 6 years:—

Years.	Mysore.			Shimoga.			Bangalore.			Hassan.			Kadur.		
	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.
	Tons.	Tons.	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.
1882—83......	574	260	96,377	817	849	2,70,716	141¼	39½	17,049	185½	162¼	47,180	225	124	39,644
1883—84......	217¾	308¼	73,728	806	845	2,71,626	108	¾	615	241¾	211½	70,550	115½	90	20,220
1884—85......	309	393½	1,15,032	884½	140	75,643	1¼	228¼	52,595	260½	193¾	63,489	68½	48¼	12,954
1885—86......	261½	454	1,57,308	261¼	530	1,79,439	182	158½	38,405	227½	274¾	94,218	78¾	145¾	45,492
1886—87......	521½	493¾	1,46,367	396¾	754½	2,53,471	113	164	63,604	187¼	194	71,490	166	203½	75,480
1887—88......	940½	866¼	2,28,215	798¾	835¼	2,53,893	184	159¾	56,811	230¾	254¾	96,245	211¾	144½	47,281
	2,824¼	2,776¾	8,17,027	3,964¾	3,993¼	13,04,788	729¼	753½	2,29,079	1,333¼	1,291	4,43,172	865½	756	2,41,071

Average Summary calculated on the 6 years.

District.	Collection.	Sold.	Revenue.	Average rate per ton sold.
	Tons.	Tons.	Rs.	
Shimoga District......	660⅗	666	2,17,465	326⅕
Mysore do.	470⅗	463	1,36,171	294
Hassan do.	222⅕	215	73,862	343⅕
Bangalore do.	121⅘	125	38,180	305⅗
Kadur do.	144⅕	126	40,178	319

Years.	Collection.	Sold.	Revenue.	Average rate per ton sold
	Tons.	Tons.	Rs.	
1882—83	1,942¾	1,434¾	4,70,966	328¼
1883—84	1,4⁸9	1,456	4,36,739	300
1884—85	1,523¾	1,043¾	3,19,713	306¼
1885—86	1,011	1,563	5,14,862	329½
1886—87	1,384½	1,809¾	6,10,412	337¼
1887—88	2,365¾	2,261	6,82,445	302
	9,716¾	9,568¼	30,35,137	317

" Thus, the revenue from sandalwood in 1887-88 amounted to no less than Rs. 6,82,445, while the average revenue for the 6 years reaches Rs. 5,05,856.

" There is but a slight variation between the prices obtained for the various classes of sandal at the sales held in the various Kothis of the Province, so the prices obtained last year in the Mysore District, though somewhat lower than those obtained in certain other Districts, will afford a fair idea of the value of the different classes.

"Rates obtained in auction in the Mysore District in December 1887:—

	Rs. per ton.
1st class (selected logs)	514
2nd class (do)...	496
3rd class (do)...	485
4th class (do)...	487
5th class (logs)	471
Roots	383
Jajpokal (ordinary commercial)	352
Bagaradad (do. inferior)	372
Powder	322
Ain Bagar (inferior wood)	311
Ain Chilta (common chips)........................	187
Hutri Chilta (coarse do.)	168
Basola Bukni (adzed do.)...........................	47
Milva Chips (mixed do.).............................	85

"The yield of sandalwood from the Mysore Province is capable of expansion. Until recently little attention was paid to artificial reproduction and the encouragement and artificial enhancement of natural reproduction, the supply being obtained solely from natural growth. Now, however, extensive measures, having for their object Sandal reproduction throughout the Province, are being carried out, and no practical limit to the possible supply of this valuable tree, beyond the necessary question of demand, is conceivable.

"*Chief Markets for Sandalwood.*—It will be matter for surprise that so valuable a wood, and one of which a single Province may almost be said to hold the monopoly, should be so little known outside India.

"The fact is that the trade in Mysore sandalwood has hitherto been confined to a ring, consisting chiefly of Muhammadan Seits, who either as principals or as agents of Bombay Firms, attend the local sales and send the sandalwood purchased by them to Bombay. The transit to Bombay from the coast is by sea in native craft. The Railways might perhaps secure this traffic if they offered special rates.

"The carts that convey the sandalwood to the coast are hired at low rates, as they are certain of return loads of salt and other merchandise to Mysore. Until recently, nearly all the sandalwood sold in the auctions held by the Mysore Government, went to Bombay, but a demand having lately arisen for sandal oil for medicinal purposes, some direct shipments of wood for extraction of oil to France and Germany, and, probably, also to America, have been made."

A small quantity of sandalwood is produced in the Madras Presidency, and in the Bombay districts of North Canara and Dharwar. The following figures show the revenue obtained from the wood in the Madras districts in 1889-90:—

North Arcot......	Rs. 5,688	Average price, Rs. 4	per cwt.
South Arcot......	„ 1,385	„ „ „ 15	„
Salem	„ 5,679	„ „ „ 15	„
North Coimbatore	„ 194	„ „ „ 12	„
Nilgiris	„ 5,616	„ „ „ 13	„
Total......	18,562		

Statement of Sandalwood collected in the North Canara and Dharwar Districts in 1889-90 *and sold by auction at Kumpta.*

No.	Class of Sandalwood.	No. of billets.	Quantity.			Rate.			Amount.		
			K.	m.	lb.*	Rs.	a.	p.	Rs.	a.	p.
1	1st class	363	18	7	20	142	4	8	2,616	2	2
2	2nd do.	472	13	3	19	140	1	7	1,847	0	9
3	3rd do.	436	7	0	2	136	6	11	955	8	10
4	4th do.	933	12	0	10	138	6	8	1,663	7	5
5	5th do.	546	4	0	11	133	0	0	534	9	11
6	6th do.	1,424	5	0	6	120	0	0	601	4	7
7	Roots	1,056	9	12	26	130	0	0	1,254	0	6
8	Jajpokal	53	1	0	0	114	0	0	114	0	0
9	Small pieces............	721	0	10	9	75	0	0	38	11	4
10	Trimmings Bags	38	3	7	16	38	0	0	128	6	2
11	Sawdust do.	3	0	4	17	90	0	0	20	11	9
12	White wood	573	8	7	7	16	0	0	133	12	9
	Total......	......	82	15	3	....			9,907	12	2

* The Bombay kandy of 20 maunds of 28 lbs.

In 1889-90 the total quantity of sandalwood offered for sale in Mysore was 2,384 tons, 3 cwts., 63 lbs. Of this quantity only 2 tons, 16 cwts., 105 lbs., were placed in the first class. The total revenue yielded was Rs. 8,82,031.

The quantities sold at the different Kothis were—Hunsur Kothi, 673 tons, 13 cwts., 58 lbs.; Seringapatam Kothi, 439 tons, 11 cwts., 28 lbs.; Hassan Kothi, 180 tons, 9 cwts., 28 lbs.; Chikmangalur Kothi, 132 tons, 14 cwts., 70 lbs.; Jirthahalli Kothi, 233 tons, 13 cwts., 48 lbs.; Shimoga Kothi, 471 tons, 14 cwts., 6 lbs.; Shikapur Kothi, 252 tons, 7 cwts, 49 lbs. Of the 673 tons, 13 cwts., 58 lbs. offered for sale at Hunsur Kothi, only 148 tons, 4 cwts., 28 lbs., consisted of logs, which were classified as follows:—

	Tons.	cwts.	lbs.	Price given.
1st class	...	10	28	Rs. 601 per ton.
2nd „	6	5	84	„ 596 „
3rd „	60	4	84	„ 575 to 582 per ton.
4th „	21	3	56	„ 570 to 574 „
5th „	6	...	...	„ 554 „

The roots fetched prices ranging from Rs. 416 to Rs. 449, the sawdust Rs. 420, and the chips and trimmings from Rs. 70-8 to Rs. 301.

Sandalwood oil.—The Mysore Government has long had establishments for extracting the oil, which is sold at the annual auction along with the wood, and chiefly bought up for exportation to China and Arabia. It is procured from the wood by distillation, the roots yielding the largest quantity and finest quality of oil. The body of the still is a large globular clay pot with a circular mouth, and is about 2½ feet deep by 6½ in circumference at the bilge. No capital is used, but the mouth of the still, when charged, is closed with a clay lid having a small hole in its centre, through which a bent copper tube about 5½ feet long is passed for the escape of the vapour. The lower end of the tube is conveyed inside a copper receiver, placed in a large porous vessel containing cold water. When preparing the sandal for distillation, the white or sap wood is rejected, and the

heartwood is cut into small chips, and distillation is slowly carried on for ten days and nights, by which time the whole of the oil is extracted. As the water from time to time gets low in the still, fresh supplies are added from the heated contents of the refrigerator. The quantity of oil yielded by wood of good quality is at the rate of 10 ozs. per maund, or 2·5 per cent. It is transparent and of a pale yellow colour, and has a resinous taste and sweet peculiar smell, which is best appreciated by rubbing a few drops of the oil on the warm hand. Its specific gravity is about 0·980. (*Bidie.*) The average price in India is about Rs. 8 per lb.

From Mr. Russell's report we learn that recently Messrs. F. Smith, of Bangalore, and W. F. Petrie Hay, of Hunsur, have, with permission, been making experimental distillations. Their samples were clear and good, but it has been brought to notice that the use of iced-strainers would be necessary to prevent the oil becoming thick or cloudy when exported to colder regions.

False Sandalwoods of Eastern Commerce.—The wood of **Santalum Preissii** (South Australian sandalwood) is dark-brown in colour, with unusually close tenacious texture, and extraordinarily hard and heavy. It is much sought for in China, where the oil is used for medicinal purposes and to perfume soaps. Messrs. Schimmel & Co. distilled 75 kilos of the wood and obtained 3 kilos, 800 grams, of oil. The wood, therefore, is one of the richest sandalwoods for oil. In many respects the latter is characteristic and interesting; it is viscid, of a cherry-red colour, and specifically heavier than water. At 15° C. its sp. gr. is 1·022. The oil possesses the property of solidifying at medium temperatures and separating acicular crystals, so that in the process of distillation the cooling must be very carefully effected, otherwise the condensing tubes become blocked. This phenomenon occurs especially in the medium fractions of the oil. The rasped wood has an agreeable balsamic odour with a suggestion of rose oil which is not perceptible in the normal oil. By separating the oil into a number of fractions, the rose odour can be recognised in some

of the middle fractions. (*Berichte von Schimmel & Co.,* 1891.) The wood of **Santalum cignorum** (West Australian sandalwood) has a sharp odour which distinguishes it from true sandalwood. The oil, which has the same peculiarity, has a sp. gr. of 0·953, rotation +5° 20.

African Sandalwood (botanical origin unknown) is reddish-brown in colour, and very hard and close. Distilled with water it yields 3 per cent. of a ruby-red oil having the consistence of true sandalwood oil. Its sp. gr. at 15° C. is 0·969. The odour resembles that of West Indian sandal oil. (*Berichte von Schimmel & Co.,* 1891.) This wood is largely imported into Bombay; a sample kindly supplied by Messrs. Schimmel & Co. was found to agree exactly with that sold in the bazaar. It is used in India as a cheap substitute for true sandalwood.

EUPHORBIACEÆ.

EUPHORBIA PILULIFERA, *Linn.*

Fig.—*Jacq. Icon., t.* 478; *Burm. Thes. Zeyl., tt.* 104—105, *f.* 1.

Hab.—Throughout the hotter parts of India. The herb.

Vernacular.—Dudhi (*Hind.*), Bara-keru (*Beng.*), Goverdhan, Mothidudhi, Nayeti (*Mar.*), Dudheli (*Guz.*), Amumpatchai-arissi (*Tam.*), Bidari, Nánabala (*Tel.*), Gentikasa, Barasu (*Can.*).

History, Uses, &c.—This plant is not mentioned by Hindu medical writers, nor does there appear to be any Sanskrit name for it. It is known, however, as a popular remedy for worms, bowel complaints, cough and gonorrhœa, and as a local application for the cure of ringworm, the Marathi name *Nayeti* signifies ringworm. Ainslie (ii., 99) remarks:—"If we may believe Piso (*De Med. Brazil*), and Barham (p.180), it possesses most extraordinary qualities, such as a few drops of the juice

of it killing serpents; its efficacy in venereal complaints and dry bellyache; and its being an antidote to poisons."

Recent investigation has, however, thrown more light upon the properties of the plant. Marsset has discovered that it kills small animals by paralysing the respiration and the heart, through its direct action on the respiratory and cardiac centres. The active principle is eliminated by the liver, for in all the animals which died during the experiments the gall-bladder was found to be distended with bile. He has published excellent results obtained with it in the dyspnœa of asthma, emphysema and bronchitis, these good results depending upon a particular modification of the functions of the pneumogastric. (*Contrib. à l'étude bot. phys. et therap. de l'Euphorb. pil.* Paris, 1884.) Tison and Beaumetz obtained very satisfactory results from it in dyspnœa of cardiac origin. It appears to act beneficially upon spasmodic dyspnœa, from whatever cause arising, and it unquestionably is a remedy of great power and promise. (*Whitla.*) Its action is not cumulative. The active principle being soluble in water and dilute alcohol, an abundant watery vehicle should therefore be employed. An extract made with water or weak spirit keeps well. In decoction, 1 oz. of the fresh plant or ½ oz. of the dried plant may be used with 2 quarts of water, and be reduced by simmering to one quart; the addition of 1½ to 2 ozs. of alcohol will prevent it from spoiling in a cold climate, but in India the decoction should be made fresh every 2 days. The extract may be given in 1 gram doses, dissolved in syrup or water; it should not be prescribed in pill, on account of its irritant action on the gastric mucous membrane. The decoction is given in doses of a wine-glassful three or four times a day; both preparations are best given after meals or immediately before them. Attention has been redirected to this drug, as of value in the treatment of hay asthma and coryza, by Dr. Rosecrans Workman (*Therap. Gaz.*, July 15, 1890), who states that in thirteen cases of hay asthma, prompt relief was obtained in nine, in one of the other cases partial relief was obtained, and in the remaining three cases the results were negative. The fluid extract was administered in doses of 30 to 60 minims every

four hours. In nearly all the above cases iodide of potassium and arsenic had been previously used. In nine cases of coryza, good results were obtained in six, the sneezing and rhinal flow ceasing or diminishing within thirty-six hours after the administration of the drug was begun. The doses were repeated every three or four hours. In five cases of asthma of frequent recurrence and long standing, marked relief was experienced in one case: the dyspnœa soon disappeared and the attacks were always shortened. In the other four cases no good effects were obtained.

Description.—Annual, hairy, obliquely-erect, with the apices recurved; leaves opposite, obliquely-oblong, serrulate; flowers small, numerous, in globular, axillary, shortly-peduncled clusters; seeds ovoid. The acute leaves, hispid hairiness, and small fruit render this species easily recognizable.

Chemical composition.—The plant has been examined by J. H. Bunting (*Amer. Journ. Pharm.*, 1888, 552), whose analysis shows the presence of the following constituents: wax, caoutchouc, chlorophyll, resin, tannin, sugar, mucilage, carbohydrates, albuminoids, calcium oxalate, and other salts.

Nothing is known of the active principle beyond the facts that it is soluble in water and weak spirit, and insoluble in alcohol of 90°, ether, chloroform, bisulphide of carbon and oil of turpentine; it is supposed to be a gum-resin. The watery solution on evaporation to dryness leaves a deep reddish-brown substance, having a vitreous fracture, hardly any taste and a strawberry odour. (*Bardet et Egasse, Form. des Nouv. Remèdes*, Paris, 1886.)

EUPHORBIA THYMIFOLIA, *Burm.*

Fig.—*Burm. Thes. Zeyl., t.* 105, *f.* 2; *Rheede, Hort. Mal. x., t.* 33.

Hab.—Throughout India and Ceylon, Central Asia, and all hot countries, except Australia.

Vernacular.—Chhoti-dudhi, Nigáchúni (*Hind.*), Rakta-keru, Dudhiya (*Beng.*), Chin-amam-patchai-arissi, Sittrapaládi (*Tam.*), Bidari-nána-biyyam (*Tel.*), Dákti-dudhi, Lahan-nayeti (*Mar.*), Dodhuk, Hazárdána (*Punj.*).

History, Uses, &c.—This plant is not mentioned in the standard Sanskrit medical works, but, along with the allied species *E. granulata*, Forsk., *E. microphylla*, Heyne, and *E. Clarkeana*, Hook *f.*, which the natives do not distinguish from it, it is used medicinally in most parts of India and the East. The author of the *Khulásat-el-tajárib* states that it is a small milky prostrate plant with slender reddish stems, and opposite leaves about the size of a split lentil seed, very common about Merv in sandy ground. It is hot and dry in the first of the third degree; the expressed juice or powdered plant with wine is given as a remedy for the bites of venomous reptiles, and is applied externally to the bitten part; with milk it acts as a purgative and expels all noxious humors from the body. According to Ainslie, the Sanskrit name is Rakta-vindu-chhada, which would imply that it is a remedy for *Rakta-vindu*, "gonorrhœa with sanious discharge." He remarks:—"The very small leaves and seeds of this low-growing annual plant, which, in their dried state, are slightly aromatic and a little astringent, are given by the Tamool doctors, in worm cases, and in certain bowel affections of children; they are commonly administered in the form of powder, and in buttermilk, to the quantity of one pagoda and a quarter weight in the course of the day on an empty stomach. The leaves when carefully dried smell something like tea." (*Mat. Ind.*, ii., 75.) Irvine states that it is used as a stimulant and laxative in Northern India. In the Concan the juice is used to cure ringworm, and mixed with chloride of ammonium for the cure of dandriff. O'Shaughnessy says that the juice is a violent purgative, and that the fresh plant is, by the Arabs, applied to wounds. In the *Dict. Econ. Prod. of India*, it is stated, on the authority of the Rev. A. Campbell, that the Santals use the root of this plant, which they call Nanha-pusi-toa, as a remedy for amenorrhœa.

Description.—A much branched annual prostrate plant, more or less hispidly pubescent, leaves opposite, $\frac{1}{6}$ to $\frac{1}{3}$ inch, petioled, obliquely-oblong, obtuse, crenulate, glabrous or pubescent beneath, stipules elongate, involucres subsolitary, very minute, axillary, especially in the crowded terminal branchlets, lobes short ciliate, glands very minute, stipitate; capsules erect, obtusely keeled, pubescent; seeds with 5 to 6 shallow transverse furrows.

Chemical composition.—An alcoholic extract of the whole plant was mixed with water acidulated with sulphuric acid, and successively agitated with petroleum ether and ether, and then reagitated with ether from the solution rendered alkaline with sodic carbonate. The petroleum ether extract contained a large amount of colouring matter; it had a very faint bitter taste; on standing, dark, and what appeared to be crystalline, points separated, but which, on microscopic examination, were destitute of regular structure. Euphorbon was specially sought for, but we arrived at no definite conclusion relative to its presence.

The acid ether extract was of a greenish colour, and partly soluble in water, the solution giving a greenish coloration with ferric chloride, and precipitating gelatine, but giving no reaction with cyanide of potassium.

After washing off by cold alcohol the extractive adhering to the sides of the capsule, and which was insoluble in water, a sulphur-yellow deposit was left, which, on microscopic examination, consisted of very minute needles. This principle was present in only minute traces, and was soluble even in warm alcohol with difficulty; it gave the reactions of quercitrin.

The aqueous original acid solution, before the addition of sodic carbonate, was of a bright claret colour; on the addition of the alkali sage-green flocks separated, the addition of acids causing solution, and reproducing the original claret-coloured solution; but after standing, the flocks became insoluble in acids,

and only a faintly yellowish-red tint was produced by their addition.

The alkaline ether extract contained an alkaloidal principle which crystallized in fine colourless feathery crystals; it possessed no bitter taste. With Fröhde's reagent in the cold a very faint-yellow tint was produced, which was changed to greenish on gently warming. Concentrated nitric acid gave a yellowish tint. Sulphuric acid and potassium bichromate no colour reaction.

EUPHORBIA TIRUCALLI, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 44. Milk-bush (*Eng.*), Euphorbe antivenérien (*Fr.*).

Hab.—Africa. Cultivated in India and the East. The juice and bark.

Vernacular.—Bár-ki-thohar, Bár-ki-sehund (*Hind.*), Káda-nivali (*Mar.*), Netrio-thora, Thora-dánadálio (*Guz.*), Kalli-kombu (*Tam.*), Káda-jemudu (*Tel.*), Bonta-kalli, Káda-nevali (*Can.*), Tiru-kalli (*Mal*), Lanka-sij (*Beng.*).

History, Uses, &c—This shrub has been introduced into the East from Africa, and is much used for making fences round cultivated fields, as cattle will not break through it owing to the acrid nature of the milky juiee. The earliest notice of *E. Tirucalli* that we know of is in the *Kámus,* which was written about the middle of the 14th century; it is there called دهن (dihan), the name by which it is still known in Arabia (*Forskahl*), and is described as a noxious plant, used to poison wild beasts. The plant is not mentioned in the Nighantas, but the juice is in general use among the natives of India as a purgative, and, applied locally, as a counter-irritant. Rheede states that a decoction of the root is given in certain cases of colic, and that the milky juice mixed with melted butter is prescribed as a purge. It is the *Ossifraga lactea* of Rumphius, who says that the bark is applied in Java to fractures. According to Horsfield, the Javanese, who call it *Kayoo-oorb,* also use

it as a vesicant. Virey (*Hist. Nat.*, p. 299) says :—Il guérit très bien l'affection venérienne ; il est aussi purgatif et vomitif." Loureiro notices its caustic nature : "Occulos si tangat excæcat." (*Ainslie, Mat. Ind.*, ii., 133 and 425.) In the Concan 1 to 4 drops of the milky juice are given with treacle or the flour of *Cicer arietinum* as a purge, and the charcoal, which is very light, is used in making pastilles. Dr. G. Y. Hunter speaks of the juice as a good application in neuralgia. In Goa it is used for poisoning fish.

Description.—A shrub or small tree, 15—20 feet, with numerous slender branches, smooth, and of a bright-green colour, having a few, most minute leaves at the extremities, which soon fall off ; as the plant grows older, the stalks become stronger, and at length woody and of a brown colour. The wood of old trees is white, close-grained and strong ; it produces a good charcoal for gunpowder and other purposes.

Chemical composition.—See next article.

EUPHORBIA NERIIFOLIA, *Linn.*

Fig.—*DC. Plant. Grasses, ii., t.* 46 ; *Rumph. Herb. Amb. iv., t.* 40.

Hab.—Deccan Peninsula, Beluchistan, Malay Islands. Cultivated elsewhere. The juice and root.

Vernacular.—Sehund, Thohar (*Hind.*), Mansa-sij, Páta-sij (*Beng.*), Nevadunga, Mingút (*Mar.*), Thohar-kántáro (*Guz.*), Ilaik-kalli (*Tam.*), Áku-jemudu (*Tel.*), Yale-kalli (*Can.*), Elak-kalli (*Mal.*).

EUPHORBIA ANTIQUORUM, *Linn.*

Fig.—*Wight Ic., t.* 897 ; *Rheede, Hort. Mal. ii., t.* 42.

Hab.—Throughout the hotter parts of India and Ceylon. The juice and root.

Vernacular.—Tidhára-sehund (*Hind.*), Tekáta-sij (*Beng.*), Tridhári-nevadunga, Nara-seja (*Mar.*), Shadhurak-kalli (*Tam.*),

Bomma-jemudu (*Tel.*), Mudu-mula-kalli (*Can.*), Katak-kalli (*Mal.*), Tandhári-thohar (*Guz.*).

History, Uses, &c.—These two plants are included under the Sanskrit names of Snuhi, Sehunda, Vajra, Vajra-tundi, Vajra-dantaka, Gandira and Maha-taru, and are supposed to ward off lightning strokes, on which account they are sometimes cultivated in pots placed on exposed positions in Hindu houses. They are sacred to Mansá, the goddess of serpents. In some parts of India, in July and August, on Tuesdays and Thursdays, the natives approach the trees with offerings of rice, milk, and sugar, praying to be delivered from snake-bites. They also employ the root mixed with black pepper as a medicine for the cure of snake-bites internally and externally. Dutt informs us that in Bengal, on the fifth day after the full moon of the month Srawan, *E. neriifolia* is planted in the court-yard of Hindu houses and worshipped.

In Western India there is a curious custom among the Concani Brahmins in connection with this plant. At the time of the Dewali they cut a portion of the stem, hollow it out, and fill it with oil, in which they place a wick. The little lamp thus formed is lighted and carried from house to house with the object of depositing it unextinguished in the house of some friend or acquaintance, saying at the same time, "A son-in-law for you," that is, wishing them good fortune (Nevadunga). The people of the house pretend not to want it, and try to extinguish the light by throwing water at it. These lamps are also placed upon little heaps of cowdung and worshipped.

In the Nighantas the plants are described as purgative, pungent, digestive, bitter and heavy, and are said to be useful in constipation, flatulent distention, tumours, swellings, abdominal enlargements, rheumatism, spleen, leprosy, mania and jaundice.

They abound in an acrid milky juice, which is a popular application to warts and other cutaneous affections. The native doctors purify arsenious acid by packing it in a hole

made in a piece of the stem, closing the hole and exposing the stem to the action of fire until it is charred. The milky juice of *E. neriifolia* is usually administered internally by soaking other purgatives and aromatics in it, so that by absorption of the juice their purgative properties become increased. A similar method is adopted when the juice is applied externally, a tent or issue pea being prepared with some finely powdered drug and steeped in it. Ainslie tells us that the native practitioners prescribe the juice as a purge and deobstruent, in those visceral obstructions and dropsical affections which are consequent of long-continued intermittent fever, the quantity given for a dose being about ¼ of a pagoda weight (20 grs.). Externally, mixed with margosa oil, it is applied to limbs which have become contracted from rheumatism. (*Mat. Ind.*, Vol. II., p. 97.) In Bombay the root is mixed with country liquor to make it more intoxicating, and the juice is used to kill maggots in wounds, and is dropped into the ear to cure earache, a practice common to many parts of India. In the Concan the stem is roasted in ashes, and the expressed juice, with honey and borax, given in small doses to promote the expectoration of phlegm; sometimes the juice of *Adulsa* is added. For asthma, *Mudar* flowers, *Aghada* root, and *Gokaran* root are steeped in the juice, powdered and given with honey and chebulic myrobalans. Dose about 4 grains. The author of the *Makhzan-el-Adwiya*, under the name of Zakúm (Euphorbia), describes four Indian species, which are probably *E. antiquorum*, *E. neriifolia*, *E. Nivulia* and *E. Tirucalli*. The milky juice of the first, he says, is mixed with the flour of *Cicer arietinum*, roasted, and administered in pills as a remedy for gonorrhœa. It has a strong purgative action. The juice of the second and third species is heated and dropped into the ear for the cure of earache; heated with salt it is given as a remedy in whooping cough, asthma, dropsy, leprosy, enlarged spleen, dyspepsia, jaundice, flatulence, colic, calculus, tumours, &c. The fourth species yields a milky juice, having similar properties. Sprengel identifies *E. neriifolia* with the ماهودانه (Mahúdáneh) of Ibn Sina, also called Hab-el-mulúk, a purgative seed of a reddish

brown colour and like a vetch.* The author of the جامع jocosely remarks that the name should be ماهر بذاته and says:— اى قايم بنفسه اى انه يقوم بذاته فى الاسهال "it is sufficient as a purgative without the assistance of any other drug." Ibn Sina describes Mahúdaneh as tricoccous and like a large filbert; he says, the name of the plant is Shibáb. It cannot be *E. neriifolia*, which has seeds no larger than a grain of mustard. In the *Dict. of Econ. Prod.*, published by the Government of India, it is stated, on the authority of Dr. J. H. Thornton, that the juice of *E. antiquorum* mixed with burnt borax and common salt is used as an application to painful joints and swellings. Dr. Thornton says:—"The fresh milky juice is a direct irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative." *E. trigona*, Haworth, the Kattimandu or "knife medicine" of the Telugus, so named because it is used for fixing knife blades in their handles, and *E. Nivulia*, Ham., have similar properties.

Description.—*E. neriifolia* is a small, fleshy, glabrous tree or shrub, branches jointed, cylindric or obscurely 5-angled, with short, sharp stipular thorns arising from thick tubercles; leaves deciduous, fleshy, obovate oblong or obovate-acute; involucres in small, stout, dichotomous, short-peduncled cymes from the sinuses, hemispheric, smooth, styles connate high up, undivided, cocci compressed, glabrous; the fruit is tricoccous, but so deeply divided that it has the appearance of three radiating slender follicles. The seed is about the size and shape of a grain of mustard, and of a greyish-brown colour.

E. antiquorum is an erect, fleshy, glabrous tree or shrub, branches terete or obscurely 3—6 angled, branchlets with 3—5 thick sinuate wings, and a pair of sharp stipular thorns in the sinuses; leaves few and small, from the sides of the wings, fleshy, obovate oblong, tip rounded; involucres 3-nate, forming short-peduncled cymes in the sinuses, styles free, 2-lobed, cocci compressed, glabrous.

E. Nivulia and *E. trigona* are very similar shrubs.

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* Hab-el-mulúk is the seed of *Croton Tiglium*.

Chemical composition.—Henke (*Archiv. d. Pharm.*, Vol. 224 (1886), 729—759) has ascertained that the dried juice of Kattimandu (*E. Nivulia*) contains 35 per cent. of *Euphorbon*, 25·40 per cent. of resin soluble in ether, 13·70 of resin insoluble in ether, 1·50 per cent. of caoutchouc, and the other constituents of commercial *gum euphorbium*. The dried juice of *E. Tirucalli* was also found to be of a similar nature, and to contain 4 per cent. of caoutchouc. Henke examined the juice of sixteen species of Euphorbia and ascertained that they all contain euphorbon, so that we may fairly suppose it, as well as an acid resin, malate of calcium, and caoutchouc, to be a constant constituent of the milky juice of all the plants belonging to the genus. (*See next article.*)

EUPHORBIA RESINIFERA, *Berg.*

Fig.—*Jackson, Account of Morocco, t.* 6; *Berg. et Sch., t.* 34 d, *f.* M—X; *Bentl. and Trim.* 240.

Hab.—Morocco. The dried juice (Gum Euphorbium).

Vernacular.—Farbiyun, Afarbiyun, Farfiyun (*Ind. Bazars*).

History, Uses, &c.—Euphorbium was known to the ancients. Dioscorides and Pliny both describe its collection on Mount Atlas in Africa, and notice its extreme acridity. According to the latter writer, the drug received its name in honour of Euphorbus, Physician to Juba II., King of Mauritania. This monarch, who, after a long reign, died about A.D. 18, was distinguished for his literary attainments, and was the author of several books, which included treatises on opium and euphorbium. The latter work was apparently extant in the time of Pliny.

Euphorbium is mentioned by numerous other early writers on medicine, as Rufus Ephesius, who probably flourished during the reign of Trajan, by Galen in the 2nd century, and by Vindicianus and Oribasius in the 4th. Ætius and Paulus Ægineta, who lived respectively in the 6th and 7th centuries, were likewise acquainted with it; and it was also known to the

Arabian school of medicine. In describing the route from Aghmat to Fez, El-Bekri of Granada, in 1068, mentioned the numerous plants of *El-Farbiyun* growing in the country of the Beni Ouareth, a tribe of the Sanhadja. (*Pharmacographia.*) Ibn Sina notices the drug under the name of Farbiyun; Haji Zein states that it is called Farbiyun, Afarbiyun, Farfiyun and Tákúb, and that the men who collect it have to tie up their faces to prevent the dust entering their mouths, as it would cause all their teeth to fall out. He says that as soon as it is collected, it is mixed with husked beans to preserve its strength, and that when fresh it is of a yellow colour, translucent, and easily soluble in olive oil; when old it turns reddish-yellow, the odour is acrid. As regards its medicinal properties, he states that it is a useful application in sciatica, palsy, colic, lumbago, and removes phlegmatic humors from the joints and limbs; internally administered it acts as a purgative of bile and phlegm. However used, it should always be diluted with such substances as oil of roses (fatty extract), bdellium, extract of liquorice, tragacanth or gum arabic; the dose is from one carat to one dang. When given internally to women, it causes abortion, but a pessary containing one grain of euphorbium causes the mouth of the uterus to contract and prevents abortion. Mixed with honey it is used in purulent ophthalmia. Three dirhams is a fatal dose, causing ulceration of the stomach and intestines; the antidotes for it are sour milk, the juice of sour pomegranates, and camphor.

The author of the *Tuhfat-el-muminin* gives almost a literal translation of what Dioscorides says about euphorbium, and reproduces a great part of Haji Zein's account of it; he mentions its use as a snuff, when diluted with beet juice, in certain affections of the brain, as a dusting powder to remove proud flesh, and as an enema in obstructed menses. In modern medicine, euphorbium is never given internally, but it is still sometimes employed as an errhine, after having been largely diluted with some inert powder, in amaurosis, deafness, and other chronic brain diseases. Its use as a counter-irritant is now almost entirely confined to veterinary practice.

Description.—The drug consists of irregular pieces, seldom more than an inch across and mostly smaller, of a dull yellow or brown waxy-looking substance, among which portions of the angular spiny stem of the plant may be met with. The substance is brittle and translucent, and has a somewhat aromatic odour; it is extremely acrid, and the dust is powerfully irritant if inhaled.

Chemical composition.—An analysis of selected fragments free from extraneous matter by Flückiger (*Vierteljahresschrift fur prakt. Pharm.*, xvii. (1868), 82—102) shows the composition of the drug to be as follows:—

Amorphous resin, $C^{10}H^{16}O^{2}$	38
Euphorbon, $C^{15}H^{22}O$	22
Mucilage	18
Malates, chiefly of calcium and sodium	12
Mineral compounds	10
	100

The amorphous resin is readily soluble in cold 70 per cent. alcohol. The solution has no acid reaction, but an extremely burning acrid taste. By evaporating the resin with alcoholic potash, and neutralizing the residue with a dilute acid, a brown amorphous substance, the *Euphorbic Acid* of Buchheim, is precipitated. It is devoid of acridity, but has a bitterish taste. From the drug, deprived of the amorphous resin ether or petroleum takes up the *Euphorbon,* which may be obtained in colourless, although not very distinct, crystals, which are at first not free from acrid taste, but by repeated crystallizations, and finally boiling in a weak solution of permanganate of potash, may be so far purified as to be entirely tasteless. Euphorbon is insoluble in water; it requires about 60 parts of 80 per cent. alcohol for solution at ordinary temperatures. In boiling alcohol it is freely soluble, also in ether, benzole, amylic alcohol, chloroform, acetone or glacial acetic acid.

Euphorbon melts at 113 to 116° C. without emitting any odour. By dry distillation a brownish oily liquid is obtained,

which requires further examination. If euphorbon dissolved in alcohol is allowed to form a thin film in a porcelain capsule, and is then moistened with a little concentrated sulphuric acid, a fine violet hue is produced in contact with strong nitric acid slowly added by means of a glass rod. The same reaction is displayed by lactucerin, to which in its general characters euphorbon is closely allied. If a few drops of an alcoholic solution of euphorbon are allowed to dry on a piece of filtering paper, and then touched with a drop of nitric acid, a blue colour will be developed.

Pure euphorbon, according to Henke, melts at 67° to 68°; its composition was found to be $C^{20}H^{36}O$. Its rotatory power dissolved in chloroform was $[\alpha]_D = +15{\cdot}^\circ 88$. Hesse assigns to euphorbon the formula $C^{15}H^{24}O$.

The mucilage of euphorbium is precipitated by neutral acetate of lead, as well as silicate or borate of sodium, it therefore does not agree with gum arabic.

If an aqueous extract of euphorbium is mixed with spirit of wine, and the liquid evaporated, the residual matter assumes a somewhat crystalline appearance, and exhibits the reactions of *Malic Acid.* Subjected to dry distillation, white scales and acicular crystals of *Maleic* and *Fumaric acids,* produced by the decomposition of the malic acid, are sublimed into the neck of the retort. (*Pharmacographia,* 2nd Ed., p. 560.)

Toxicology.—Euphorbium causes the eyes to weep and grow red, the nose to run with watery and even bloody mucus, and saliva to flow abundantly from the mouth. To prevent these effects, says Pereira, some drug-grinders employ masks with glass-eyes, others apply a wet sponge to the nose and face, while others cover the face with crape. Individuals who have been exposed for some time to the influence of this dust suffer with headache, giddiness, and ultimately become delirious. I was informed, he adds, of an Irish labourer who was made temporarily insane by it, and who, during the fit, insisted on saying his prayers at the tail of the mill-horse. In a case which fell under his notice a man

grew suddently delirious, and presently became insensible and fell in a fit. His face was red and swollen, his pulse frequent and full, and his skin very hot. On being bled, his consciousness returned and he complained of great headache.

Under Euphorbiaceæ, Norman Chevers, quoting Dr. H. Cleghorn of Madras, says:—"There are several species of Euphorbia, as the *E. neriifolia, antiquorum, acaulis,* and others which abound in a milky juice. This produces a blister when rubbed on the integuments, and serious inflammation if dropped into the eye. Several cases have happened within my knowledge, where the sight has been endangered from this cause." (*Indian Med. Jurisprudence.*)

Other species of Euphorbia found in India, and occasionally used medicinally, are **E. helioscopia,** *Linn.*, the Sun Spurge, a native of Afghanistan and the Punjab, **E. hypericifolia,** *Linn.*, and **E. Royleana,** *Boiss.*, a native of the outer Himalaya.

E. helioscopia is used as a hydragogue cathartic, and the juice is applied to remove warts. Dr. Baudry (*Bull. Med. du Nord,* 1887) has reported a case of severe ulceration resulting from the application of a poultice of the bruised plant.

E. hypericifolia has not unfrequently been mistaken for *E. pilulifera,* but may be distinguished readily by its not having the hairy stem of the latter plant. In Réunion it is used as an astringent in dysentery under the name of *Herbe Jean-Robert.*

PHYLLANTHUS EMBLICA, *Linn.*

Fig.—*Brand. For. Fl., t.* 52; *Bedd. Fl. Sylv., t.* 258; *A. Juss. Tent. Euphorb., t.* 5, *f.* 15; *Rheede, Hort. Mal. i., t.* 38. Emblic myrobalan (*Eng.*), Emblic officinal (*Fr.*).

Hab.—Throughout tropical India. The fruit, bark, and flowers.

Vernacular.—Ánvula (*Hind.*), Ámlaki (*Beng.*), Ávala, Avalkáthi (*Mar.*), Nelli-kai, Toppi (*Tam.*), Nelli-kaya, Usirike-kaya (*Tel.*), Nelli-kaya (*Mal.*), Nelli-kayi (*Can.*), Ambala (*Guz.*).

History, Uses, &c.—The fruit of this tree is the Dhátriphala, Amritaphala, Ámalaka or Sriphala of the Nighantas, and is described as having all the properties of the chebulic myrobalan. It is used both fresh and dried; in the former condition it is considered to be refrigerant, diuretic and laxative; in the latter, astringent. It is pickled by the natives, and, on account of a peculiar flavour which it imparts, some of the forest tribes eat it before drinking water. A sherbet of the fruit, sweetened with sugar or honey, is a favourite cooling drink for sick people; it is said to be diuretic. A country-side prescription for biliousness in the Concan is *Avala*, 4 massas, to be soaked all night in water, and in the morning to be pounded and mixed with a quarter seer of milk and flavoured with sugar and cumin. Emblic myrobalans are an ingredient in many compound preparations described in Sanskrit works. A selection of these prescriptions will be found in Dutt's *Hindu Materia Medica;* the following, translated from Chakradatta, may be taken as an example:—

"*Dhátri lauha.*—Take of powdered Emblic myrobalans 64 tolás, prepared iron 32 tolás, liquorice powder 16 tolás, mix them together, and soak in the juice of *Tinospora cordifolia* seven times successively. This preparation is given in jaundice, anæmia and dyspepsia, in doses of from 20 to 40 grains."

Mahometan physicians esteem this myrobalan equally with the Hindus; they describe it as astringent, refrigerant, cardiacal, and a purifier of the humors of the body. It is much prescribed by them in fluxes, and is also applied externally on account of its cooling and astringent properties The Arabic name is Amlaj, and the Persian Ámala. Ainslie states that the flowers, which have an odour resembling that of lemon peel, are supposed by the Vytians to have virtues of a cooling and aperient nature, and are prescribed in conjunction with other articles in the form of an electuary. (*Mat. Ind.*, ii., p. 244.) In the *Pharmacopœia of India* it is stated, upon the authority of Dr. Æ. Ross, that the root by decoction and evaporation yields an astringent extract equal to catechu, both for medicinal

purposes and in the arts; the chips of the wood or small branches thrown into impure or muddy water, according to the same authority, clear it effectually. In the Concan the juice of the fresh bark, with honey and turmeric, is given in gonorrhœa.

Description.—Fresh Emblic myrobalans are globular, fleshy, smooth, six-striated, of a yellowish-green colour, and sometimes as large as a walnut; they contain an obovate obtusely triangular, 3-celled nut, each cell of which contains two triangular seeds. The taste of the pulp is acid, astringent, and somewhat acrid. The dried fruit is the size of a cob nut, sub-hexagonal, wrinkled, of a grey-black colour if it has been collected when immature, but yellowish-brown if mature; the latter upon pressure breaks up into six parts, each of which consists of a section of the pulp and nut, and contains one triangular brown seed.

Chemical composition.—The pulpy portion of the fruit dried at 100°C., and freed from the nuts, had the following composition:—

Ether extract (gallic acid, &c.)	11·32
Alcoholic ,, (tannin, sugar, &c.)	36·10
Aqueous ,, (gum, &c.)	13·75
Soda ,, (albumen, &c.)	13·08
Crude cellulose	17·80
Mineral matter	4·12
Moisture and loss	3·83
	100·00

The acidity of the fruit was found to be equal to 9·6 per cent., calculated as acetic acid. The amount of tannic acid, estimated with acetete of lead solution, was 35 per cent., and 10 per cent. of glucose was estimated by means of Fehling's solution on an infusion of the pulp after the removal of the tannin.

Löwe considers this tannin to be identical with the ellago-tannic acid of Divi-divi.

Commerce.—Two kinds of Avala are found in commerce, one entire, and the other cut up, and the nut removed. The fruit is collected in many parts of India. Value, about Rs. 32 per candy of 7 cwts.

PHYLLANTHUS RETICULATUS, *Poir.*

Fig.—*A. Juss. Tent. Euphorb.* 19, *t.* 4, *f.* 1; *Wight Ic.*, *t.* 1899; *Burm. Thes. Zeyl.*, *t.* 88.

Hab.—Throughout tropical India. The leaves and bark.

Vernacular.—Pánjoli (*Hind.*), Púlagúda (*Tel.*), Púlavayr (*Tam.*), Pánkúshi (*Beng.*), Pavana, Puvana (*Mar.*), Kamohi (*Sind.*), Datwan (*Guz.*), Katu-nirūri (*Mal.*).

History, Uses, &c.—Ainslie (*Mat. Ind.*, ii., 223) gives Krishna-kámboji as the Sanskrit name of this plant. Kámboja, "coming from Kámboj," is applied in that language to several plants, but none of them have been identified with *P. reticulatus*, nor does it appear to be mentioned in the Nighantas under any other name. The leaves and bark are used as a diuretic and cooling medicine and as an alterative. Ainslie says:—"This bark, as it appears in the Indian bazars, is commonly in pieces about a foot long, and as thick as the wrist, of a dark colour outside, and of a faint sweetish taste; it is considered as alterative and attenuant, and is prescribed in decoction, in the quantity of 4 ounces or more twice daily." In the Concan the juice of the leaves is made into a pill with camphor and cubebs, and dissolved in the mouth as a remedy for bleeding from the gums; it is also, along with the juice of other alterative plants, reduced to a thin extract, and made into a pill with aromatics. This pill is given twice a day, rubbed down in milk, as an alterative in heat of blood.

Description.—Shrubby, climbing, primary branches twiggy; young shoots pubescent; floriferous branchlets angular; leaves oval-obtuse, bifarious; flowers axillary, aggregated, several males and usually one female; male flowers purplish; berries size of a pea, dark-purple. This plant is common near water, and extends to Sind, where it is found in the forests of

great size, climbing to the tops of the highest trees. (*Bomb. Flora.*) The flowers have a peculiar and disagreeable smell. The bark is dark-brown externally, and thickly studded with little elliptic warty rings; beneath the suber is a deposit of chlorophyll, but the substance of the bark is of a dull-red colour. Taste sweet and astringent. Microscopically there is little to remark beyond masses of deep purple pigmentary matter and groups of large stone cells.

Chemical composition.—The leaves contained a tannic acid similar to that separated from other species of this genus, but no alkaloid. A crystalline principle soluble in ether was removed from the aqueous solution of the alcoholic extract; it gave a yellowish-brown colour with sulphuric acid, a brown colour with Fröhde's reagent, and a yellow solution with alkalies. The powdered air-dried leaves afforded 7·83 per cent. of ash, and when mixed with water became very mucilaginous, and it was very difficult to filter this mixture through paper.

Phyllanthus madraspatensis, *Linn., Wight Ic.,* 1895, *f.* 3, yields the Kanocha seed of the bazars. The seeds are polished, triangular, of a grey colour, prettily marked with delicate dark-brown lines like basket-work; length $\frac{1}{10}$ of an inch; breadth somewhat less; one side is arched, the other presents two sloping surfaces united to form a longitudinal ridge, at the pointed end is a small scar marking the attachment to the ovary; the testa is hard and brittle. When soaked in water they immediately become thickly coated with a semi-opaque mucilage; the kernel is oily and has a sweet nutty taste; the seeds are used medicinally on account of the mucilage which they afford.

PHYLLANTHUS NIRURI, *Linn.*

Fig.—*Wight Ic., t.* 1894; *Rheede, Hort. Mal. x., t.* 15.

PHYLLANTHUS URINARIA, *Linn.*

Fig.—*Wight Ic., t.* 1895, *f.* 4; *Rheede, Hort. Mal. x., t.* 16.

Hab.—Throughout India. The herbs.

Vernacular.—Bhumi-a'nvala (*Hind.*), Bhui-amla (*Beng.*), Bhui-a'vala (*Mar.*), Kizhkay-nelli (*Tam.*), Nelli-usirika (*Tel.*), Kizha-nelli (*Mal.*), Kiranelli-gida (*Can.*), Bhui-amali (*Guz.*). *P. urinaria* is distinguished by the addition of the adjective red to the above names.

History, Uses, &c.—These plants are common weeds which appear in the cold season. They are called in Sanskrit Támra-valli (*P. urinaria*) and Bhumy-ámali (*P. Niruri*), and bear among other synonyms those of Tamalika, Bhu-dhátri, and Bahu-pattra, "having many leaves." Hindu physicians consider them to be deobstruent, diuretic, astringent and cooling, and prescribe the dried plant in powder or decoction in jaundice. The dose of the powder is about a teaspoonful. Mir Muhammad Husain in the *Makhzan* states that the milky juice is a good application to offensive sores, and that a poultice of the leaves with salt cures scabby affections of the skin; without salt it may be applied to bruises, &c. From Ainslie we learn that these two plants are the *Herba mœroris alba* and *rubra* of Rumphius, and that an infusion of the leaves of *P. Niruri* with fenugreek seed is considered a valuable remedy in chronic dysentery, also that the leaves are a good stomachic bitter. In Bombay *P. Niruri* is used as a diuretic in gonorrhœa and acidity of the urine. The dose is 2 tolás of the juice with 2 tolás of ghí twice a-day. The root rubbed down with rice-water is given in the Concan as a remedy for menorrhagia.

Dr. A. J. Amadeo states that the plant is known as *Yerba de quininic* at Porto-Rico, and is used in decoction in intermittent fevers; he thinks favourably of it, and uses a tincture in 2-drachm doses; it acts as a gentle purgative, and is especially useful when the liver and spleen are infarcted. It is diuretic.

Description.—*P. Niruri:* Annual, erect-branched; branches herbaceous, ascending; floriferous branchlets filiform; leaves elliptic, mucronate, entire, glabrous; male and female flowers in separate axils, male on the lower ones; dehiscence of anthers transverse; glands in the female bifid

and trifid; capsule globose; two smooth seeds in each cell; seeds triangular.

P. urinaria: Root generally annual, though in some soils biennial and even perennial. Stem erect, striated, of a pale reddish colour; branches several, ascending, striated from the insertions of the stipules; leaves scattered, spreading, pinnate, from one to two inches long, flower-bearing; leaflets alternate, linear oblong, entire, smooth, $\frac{3}{4}$ of an inch long, and $\frac{1}{4}$ broad; petioles compressed, somewhat triangular; stipules of the petioles 3-fold, acute, membranaceous, those of the leaflets two, lateral; male flowers, exterior leaflets axillary, 2 to 3, subsessile; calyx, nectary and stamens as in *P. Niruri*; female flowers, lower leaflet axillary, solitary, sessile; calyx and nectary as in the male; capsules scabrous, 3-celled, 6-valved; seeds, two in each cell, transversely striated on the outside. It is immediately distinguished from *P. Niruri* by its sessile flowers and scabrous capsules. (*Roxb.*)

Chemical composition.—The alcoholic extract from the whole plant was mixed with water acidulated with sulphuric acid, and agitated first with petroleum ether, then with ether, and finally rendered alkaline and reagitated with ether.

The petroleum ether extract was dark-coloured, and soft, with a tea-like odour, and extremely and persistently bitter. It was mixed with 3 per cent. caustic soda solution and reagitated with petroleum ether, which removed the bitter principle contaminated with traces of oil and colouring matter. This extract gave the euphorbon colour reaction when treated with sulphuric and nitric acids. For the bitter neutral principle, we propose the name of *pseudochiratin.*

The acid ether extract contained green colouring matter, and was partly soluble in water with acid reaction, the solution giving a dirty bluish-green coloration with ferric chloride, slightly precipitating gelatine, but affording no reaction with cyanide of potassium.

The alkaline ether extract contained an alkaloidal principle, which, after purification, was obtained in white feathery crystals

without any special taste. With Fröhde's reagent it gave a light yellowish-red coloration, changing to blue on heating; with concentrated nitric acid, yellowish. No reaction with dichromate of potassium and sulphuric acid.

BRIDELIA RETUSA, *Spreng.*

Fig.—*Baill. Etudes Gen. Euphorb., t.* 25, *f.* 25—34; *Bedd. Fl. Sylv., t.* 260; *Rheede, Hort. Mal. ii., t.* 16.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Khája, Kharaka, Lamkana (*Hind.*), Mulluvengai (*Tam.*), Dudhi-maddi, Kora-maddi (*Tel.*), A'sána, Phattar-phoda, Páléhasan, Kántehasan, Hasáni (*Mar.*), A'sána, Gurige (*Can.*).

History, Uses, &c.—The astringent properties of the bark of this tree appear to be well known throughout India, as it is in general use for tanning leather. The wood is also much used, on account of its durability under water, for making well-curbs. In Western India the bark has a reputation as a lithontriptic, and is in general use as an astringent medicine. The tree is with or without thorns, according to situation and soil; the natives of Western India consider the thornless tree to be a distinct species, and call it Pálehasan, whilst the thorn-bearing tree is known to them as Kántehasan. When wounded, the bark exudes a blood-red juice, which stains the hands, and is very astringent.

Description.—The dry bark is externally of a light-brown colour, and has little fungous protuberances of dead suber; internally it is smooth and fibrous, of a cinnamon colour; taste purely astringent. If soaked in water it gives out much mucilage. The fibrous portion of the bark is very tough and strong. Sections placed under the microscope show the outer portion to be made up of thin-celled reddish parenchyma; in the inner portion there is much woody fibre and numerous vessels, the external surface of which is encrusted with large crystals arranged in regular columns

Chemical composition.—The bark afforded 41·7 per cent. of water extract, containing 39·9 parts of tannic acid. The tannic acid gave a greyish-green precipitate with plumbic acetate, and a blue-black colour with ferric chloride. The air-dried bark left 7·35 per cent. of ash on incineration. Although this is one of the most astringent barks in India, it does not appear to be known to, or used by, Europeans in the arts.

CLEISTANTHUS COLLINUS, *Benth.*

Fig.—*Beddome, Foresters' Man.*, 203, *t.* 23, *f.* 5 ; *Roxb. Cor. Pl. ii.*, 37, *t.* 169. *Syns.: Lebidieropsis orbicularis*, Müll-Arg., *Cluytia collina*, Roxb.

Hab.—Dry hills, in various parts of India, from Simla to Behar. Deccan Peninsula.

Vernacular.—Oduvan, Woodacha, Nachuta (*Tam.*), Kadishe (*Tel.*)., Kodasigina, Bodadaraga (*Can.*).

History, Uses, &c.—Under the name of *Andrachne Cadishaw*, Ainslie describes the poisonous properties of the nut of this tree, called *Wodoowunghai*. He says:—"About one pagoda weight, pounded, the Tamools believe to be sufficient to kill a man; the leaves and roots of the plant are also considered poisonous; the first, which no animal will touch, is, in conjunction with *Kadukai* (chebulic myrobalans), supposed to be a good application to foul ulcers. (*Mat. Ind.*, ii., 487.) Roxburgh remarks:—" The bark or outer crust of the capsule is reported to be exceedingly poisonous." (*Fl. Ind.*, iii., 733.)

Description.—Capsule $\frac{3}{8}$ of an inch in diameter, sessile, woody, rounded-3-gonous, top not lobed, dark-brown, shining and wrinkled when dry. Seeds $\frac{1}{6}$ of an inch in diameter, globose, chestnut-brown; albumen scanty.

Chemical composition.—The active principle of the plant does not appear to be an alkaloid, but, though its chemical nature has not yet been fully investigated, Mr. Newman, Assist. Chemical Examiner, Madras, has discovered that it gives a purple reaction with sulphuric acid, which disappears on oxidising with

alkaline dichromate, and with nitric acid a blue colour changing to green; these tests serve to identify it with some degree of probability. An extract of the leaves and fruit acts as a violent gastro-intestinal irritant. (*Report, Madras Chem. Examiner*, 1885.)

Toxicology.—The Madras Chemical Examiner reported in 1885 that the poison had been found in two cases from South Arcot. "In one case a man being detected in an intrigue with his mother-in-law, her relations threatened to excommunicate her; whereupon both are supposed to have taken this poison and to have died very soon—from half an hour to an hour—after taking it. Both vomited. In the second case vomiting and purging were followed by recovery." In 1886 the same Chemical Examiner reported that the expressed juice of certain leaves (of *Oduvan*), the residue of which was sent for examination mixed with common salt, was supposed to have been taken by a man to cure itch. He suffered from vomiting and died in a few hours. In 1887 *Oduvan* was found, in a case from South Canara, in the stomach of a woman who poisoned herself when her husband was dying. She was suddenly seized with vomiting and died rapidly. In 1889 a woman was suspected of attempting suicide by poison; the leaves found in her possession were identified as those of this plant. In 1890 a pregnant woman died with symptoms of gastro-intestinal irritation, after taking an abortifacient; from her stomach was extracted a non-alkaloidal poison which gave reactions similar to those obtained from the extract of this plant.

The bark of **Flueggia Leucopyrus,** *Willd., Wight Ic., t.* 1875, a shrub of the Punjab Plain, the Deccan Peninsula, and Ceylon, is used both in Madras and Bombay as a fish-poison. The sweet, white berries do not appear to have any injurious properties, as they are eaten by children, who call them *Madh* (honey). The juice of the leaves is used to destroy worms in sores.

Chemical composition.—The bark contains 10 per cent. of a tannic acid, giving a violet-black colour with ferric chloride,

and the mixture becomes red on the addition of ammonia. An alkaloid is also present, giving a purplish-red colour, afterwards turning to green, with Fröhde's reagent, and a violet colour with strong sulphuric acid and permanganate of potassium. The alkaloid is soluble in excess of alkalies. The infusion was somewhat frothy, but no sapogenin could be isolated from it after boiling with acid.

The bark of **Flueggia microcarpa**, *Blume, Wight Ic.*, *t.* 1994, supplied by Mr. Hollingsworth as one of the South Indian fish-poisons, was in thin papery light-brown strips, and the powder had no odour and very little taste. Air-dried, it afforded 11·4 per cent. of mineral matter, and contained 8·9 per cent. of a tannin, giving a blue-black colour with ferric salts. The aqueous solution of the alcoholic extract furnished an alkaloidal principle similar in its reactions to that obtained from the bark of *F. Leucopyrus*.

Breynia rhamnoides, *Müll-Arg.*, *Wight. Ic.*, *t.* 1898, is a shrub or small tree of tropical India. According to Ainslie, it was brought to Dr. F. Hamilton, while in Behar, as a medicine of some note; the dried leaves are smoked like tobacco, in cases in which the uvula and tonsils are swelled. The bark is astringent.

Description.—Shrubby; young shoots angular; leaves alternate, short-petioled, spreading, broad-oval; exterior ones largest, below whitish, entire, half to three-quarters of an inch long; male flowers racemed from the lower axils; female flowers in the upper axils, solitary, short-peduncled, drooping; capsule size of a pea.

The nuts of **Putranjiva Roxburghii**, *Wall.*, in Sanskrit Putra-jiva or Putram-jiva, "that which makes the child live," are hung round the necks of children to keep them in good health. They are mentioned in the Nighantas as being also Garbha-kara, "productive of impregnation," and medicinal properties are attributed to them. The hard wrinkled nuts are generally worn only as a charm, but are sometimes given internally in colds on account of their supposed heating properties;

they are called Jivapota in Hindi, Kurupale in Tamil, Kabrajuvi in Telugu, Pongalam in Maliyali, and Jivanputra in Marathi.

JATROPHA GLANDULIFERA, *Roxb.*

Hab.—Deccan Peninsula, Bengal, Northern Circars, and sparingly elsewhere. The juice, root, and oil.

Vernacular.—Underbibi, Rán-erandi, Tadki-erandi (*Mar.*), Lál-bherenda (*Hind., Beng.*), U'dalai (*Tam.*), Nela-amudamu (*Tel.*).

History, Uses, &c.—This plant appears to have been introduced into India, but it is not known from whence. Graham, in his *Catalogue of Bombay Plants*, published in 1839, says that in his time it was only to be found at Punderpore in the Deccan (a place much frequented by pilgrims, who come to visit the temple of Vithoba). There is a fabulous legend that it suddenly made its appearance at this place. The following is the story, for which we are indebted to Dr. Shantaram V. Kuntak of Punderpore :—" A certain cultivator was sowing his field on the 10th day of Áshádh, during the Áshádhi fair ; whilst thus engaged he was accosted by numbers of pilgrims who were passing by his field, on their way out of the town, to meet the palanquins of Dnyánoba, Námdeo and Tukáram, which are brought to Punderpore at this season from Paithan, Alandi, and Dehu. All the pilgrims asked him what he was sowing, until the man got tired of answering their questions ; in a short time another pilgrim came up and asked the same question,—the man, vexed beyond endurance, answered that hé was sowing वोट (membrum virile). It is said that this last pilgrim was the god Vithoba in disguise, who was going to meet the palanquins of his devotees, and that, annoyed at the cultivator's answer, he cursed him, saying, 'As you sow, so may you reap.' So when harvest time came, instead of the usual crop, the whole field was covered with this short thick-stemmed plant." Until within

the last few years the field was called after the strange crop which it bore. It is now cultivated by a Mahometan, and produces a regular crop, but the Jatropha has not been entirely extirpated. Since Graham's time the plant has spread rapidly, and may be seen on waste ground in most parts of the island of Bombay, probably introduced along with the Castor seed of commerce. An oil is prepared from the seeds by roasting them in a perforated earthen vessel, fitted upon another vessel, into which, when the whole apparatus is heated in a pit filled with burning cowdung fuel, the oil drops. This oil is valued as an application to chronic ulcerations, sinuses, ringworm, &c. The root brayed with water is given to children suffering from abdominal enlargement; it purges, and is said to reduce glandular swellings. The juice of the plant is used in various parts of India as an escharotic to remove films from the eyes; it is greenish and viscid. The expressed oil of the seeds is yellow, has a specific gravity of 0·963, and solidifies at 5° C. (*J. Lepine, Jour. Phar.* [3], xl., 16.)

Description.—A small shrub, remarkable for the shining reddish-brown colour of its young foliage. The leaves are palmate, 3 to 5-cleft, panicles terminal, short, few-flowered; flowers small and red. The young branches and petioles of the leaves are thickly studded with sticky red glandular hairs. The capsules are 3-celled and 3-seeded, with an outer adherent fleshy epicarp, which dries up as the fruit ripens; when this takes place, the three triangular woody cells of which it is composed divide into six pieces suddenly with a sharp report, and the seeds are projected to a considerable distance; it is, therefore, necessary to gather the fruit before it is quite ripe and dry in a covered place. The seeds, including the strophiole, are three-tenths of an inch long and two-tenths broad; they are of a grey colour with two brown stripes on the dorsum, which is convex, the underside has two flat surfaces, divided by a central ridge. The kernel is without smell, and very oily; it has a sweet, nutty taste.

Chemical composition.—See *Jatropha Curcas.*

Jatropha nana, *Dalzell,* Kirkundi (*Mar.*), is a rare plant, found in waste, stony places near Poona. The juice is employed as a counter-irritant in the same manner as that of *J. glandulifera.*

Description.—A shrub 1 to 1½ foot high, all smooth; root tuberous, woody; root-bark thick and full of milky juice; stem round, smooth, very little branched; branches erect; leaves large for the size of the plant, sessile or shortly petioled, broadly ovate, entire or trilobate; lobes obtuse, central much the largest, 4 to 6 inches long and broad, pale beneath, 3-nerved, flowers panicled, terminal, few, 3 to 5 on each division; stipules minute; flower solitary, pedicelled, subtended by a subulate bract half its length; calyx leaves six, small, subulate; fruit obovoid, flattened at the top, slightly six-sulcated, as large as a nut. (*Dalzell.*)

JATROPHA CURCAS, *Linn.*

Fig.—*Jacq. Hort. Vind. iii., t.* 63; *A. Juss. Tent. Euphorb., t.* 11, p. 34 A. Physic Nut (*Eng.*), Medicinier (*Fr.*).

Hab.—Throughout India and Ceylon, naturalized.

Vernacular.—Bághrénda, Bágh-bherenda (*Hind., Beng.*), Moghli-erandi, Jepál (*Mar.*), Galamark (*Goa*), Káttámanakku (*Tam.*), Pépálam (*Tel.*), Káttá-vanakka (*Mal.*), Bettada-haralu (*Can.*), Jangli-arandi (*Guz.*).

History, Uses, &c.—This tree, introduced from America, is called by recent Sanskrit writers Kánana-eranda. Its seeds are sometimes used as a purgative and alterative by the Hindu physicians, but on account of their uncertain action they are not much esteemed. The oil is reckoned a valuable external application to itch, herpes, chronic rheumatism, and sores or wounds. Descourtilz states that the blacks of Rio Nunez saponify the oil with the ashes of the Papaya, and use the preparation to heal the wounds caused by circumcision.

The leaves are applied as a rubefacient and discutient, and a decoction of them is said to excite the secretion of milk in

women. The viscid juice which flows from the stem upon incision is painted over cuts and wounds to check bleeding and promote healing; this it does by forming a thin film when dry like that produced by collodion. The author of the *Makhzan* also notices this use of the juice, and calls the plant *Bághréndeh.* Mr. Udoy Chund Dutt notices the hæmostatic properties of the juice, and Dr. Evers has injected a drachm of it into a varicose aneurism. He says:— "The result was astonishing; in twenty minutes time the pulsation was so faint that no non-professional person could have detected it; and by evening all pulsation had ceased, and a good firm clot had been produced. No ill-effects resulted from the injection." *J. Curcas* is said to have been introduced from Brazil by the Portuguese; it is now quite naturalized in many parts of India, and is a common hedge-plant in the Concans. The oil is used for burning. The juice, when dried in the sun, forms a bright reddish-brown, brittle substance like shell-lac, which may yet be put to some useful technical purpose. In Goa the root-bark is applied externally in rheumatism. In the Concan it is rubbed with a little asafœtida and given with buttermilk in dyspepsia and diarrhœa. The fresh stems are used as a tooth brush to stop bleeding from the gums. Roxburgh notices that the leaves warmed and rubbed with Castor oil are used by the natives as a suppurative.

Jatropha oil was formerly employed as a purgative by European physicians, under the names of *Oleum Ricini majoris* and *Oleum infernale.* At the present time it is much used for burning and for soap-making; also for adulterating olive oil, and seemingly for making Turkey-red oil. (*F. M. Horn, Zeit. Anal. Chem.*, xxvii., 163—165.

Description.—The young roots are soft, fleshy, and tapering, with a whity-brown scaly epidermis, and a few thin rootlets, bark yellowish-white internally, with a peculiar perfume like tuberose when freshly removed; wood white and very soft. On section the bark is seen to contain oil globules and very numerous conglomerate raphides; the vascular system is full of a

yellowish viscid secretion; the wood is loaded with starch. The taste of the bark is acrid.

The fruit is ovoid, 6-striated, tricoccous and fleshy; when ripe it is of a pale greenish-yellow; as it gradually dries up it becomes black and partially dehiscent. There is one seed in each cell. The seeds (*Pignons d'Inde*) are of the same shape as Castor seeds, ¾ of an inch long and rather less than half an inch broad; the dorsal surface is arched and marked by a hardly perceptible ridge about the middle; the ventral surface has a well-marked ridge. At one end of the seed is a white scar. The testa is of a dull black and irregularly fissured all over, the fissures are yellowish. The kernel is enclosed in a thin, white membranous covering like that of the Castor seed.

The cotyledons are foliaceous, the radicle short and thick, the albumen copious and oily.

Chemical composition.—The kernels of the seeds of *J. Curcas* were found by Arnaudon and Ubaldini (*Kopp's Jahresber.*, 1858) to contain 7·2 per cent. water, 37·5 oil, 55·3 sugar, starch, albumin, casein, and inorganic matters. The kernels yielded 4·8 per cent. ash, and 4·2 per cent. nitrogen; the kernels and husks together 6 per cent. ash, and 2·9 per cent. nitrogen. The oil yielded by saponification, glycerine and an acid, which, as well as the unsaponified oil, produced caprylic alcohol by distillation with hydrate of potassium. Bouis had previously separated from it a liquid and solid fatty acid, and named the latter *Isoacetic Acid,* $C^{15}H^{30}O^{2}$. Cadet de Gassicourt (1824) found in the seeds an acrid resin.

F. M. Horn (*Zeit. Anal. Chem.*, xxvii., 163—165) states that the oil begins to crystallize at 9°, and is completely solid at 0°, at 15° its sp. gr. is 0 9192. It differs from Castor oil in its very sparing solubility in alcohol. It appears to saponify readily in the cold, but in reality forms only acid soaps; for complete saponification heat is required, and solid potash acts better than solution.

The fluid oleic acid obtained by Bouis may doubtless be regarded as ricinoleic acid.

According to Dr. H. Stillmark, the seeds contain *Ricin*, the poisonous principle of Castor seeds (see *Ricinus*).

Toxicology.—Christison (*Poisons*, p. 591) found from 12 to 15 drops to have generally the same effect as an ounce of Castor oil. Stillé and Maisch remark that it is more like Croton oil in its action. The acrid emetic principle resides chiefly in the embryo. It is stated that if the embryo is wholly removed, four or five of the seeds may be used as a purgative without producing either vomiting or griping. This opinion is supported by experiments upon dogs. A number of cases have occurred of poisoning by eating the seeds entire. In one case, a man who had eaten five of them soon complained of burning in the mouth and throat, and the whole abdomen felt distended and sore. In a few minutes vomiting occurred, and was repeated five times in the course of an hour, accompanied with active purging. The pain continued; the patient complained of feeling hot and giddy; he then became delirious, and afterwards insensible. On regaining consciousness several hours later his face was pale, his hands cool, the pulse 110 and weak. He recovered.

Several cases of accidental poisoning by the seeds have been recorded in India, and Chevers mentions one in which, in addition to the usual symptoms, muscular twitchings, deafness, impairment of sight, and loss of memory were observed.

Jatropha multifida, *Linn.*, *Salisb. Hort. Paradis.*, *t.* 91, the Medicinier d'Espagne of the French, and Coral tree of the English, is a common ornamental shrub in Indian gardens; it is not used medicinally, and only requires a brief notice on account of its seeds, which are powerfully purgative and emetic, sometimes giving rise to accidents when eaten by children. The plant is easily recognised by its multifid leaves and beautiful, red coral-like panicles of flowers. The fruit is bright-yellow when ripe, as large as a walnut, six-angled and three-celled, each cell contains a scabrous black seed resembling that of *J. Curcas*. We have found limejuice and stimulants to be the best remedies in cases of poisoning by the seeds. The

plant appears to have been introduced by the Portuguese from Brazil, where the oil of the seeds is known as *Pinhoen oil*, and is used as an emetic.

At Martinique it is called *Ipeca pays*, on account of its being used in a similar manner; one seed acts as an emeto-cathartic. Corre and Lejanne state that the Creole women used to prepare an "*Orange purgative*" by macerating an orange in the oil for a month, and then drying it; this orange, when rubbed in the hands and smelt, was believed to act as a purgative.

According to Soubeiran, the oil of these seeds is very similar to, if not identical with, that of *J. Curcas*.

Toxicology.—Cases of accidental poisoning by the fruits have been recorded in India, chiefly among children who have been attracted by their tempting colour. The symptoms have been similar to those produced by *J. Curcas*.

ALEURITES MOLUCCANA, *Willd.*

Fig.—*Lamk. Ill., t.* 791; *A. Juss. Tent. Euphorb., t.* 12; *Rumph. Amb. ii., t.* 58. Candleberry tree (*Eng.*), Aleurit des Molluques (*Fr.*).

Hab.—Pacific Islands. Cultivated in India. The oil.

Vernacular.—Jangli-akhrot (*Hind.*), Rán-akhrot, Japhala (*Mar.*), Jangli-akhroda (*Guz.*), Náttu-akhrotu (*Tam., Tel.*), Nát-akrodu (*Can.*).

History, Uses, &c.—Rumphius (iii., 12) states that the Javanese and Macassars make candles of the seeds of this tree, either pounded and mixed with cocoanut or cotton seeds, or simply strung upon a piece of split bamboo; they also eat the seeds raw and roasted. In the South of India, where the tree is much cultivated, the seeds are known as Indian walnuts. When pressed they yield a large proportion of oil, used as a drying oil for paint, and known as country walnut oil, bankoul-nut oil and artist's oil. In Ceylon it is called *Kekuni oil*, and in the Sandwich Islands, where it is used as a mordant for their vegetable dyes, *Kakui oil*. In these islands alone

about 10,000 gallons are annually produced. It has been imported into Europe for soap-making, but not to any considerable extent, and fetches about £20 per imperial ton. The oil is stated to possess powerful desiccative properties. The cake, after the oil has been expressed, is esteemed as a manure. The root of the tree affords a brown dye, which is used by the Sandwich Islanders for their native cloths. In India the oil is used as a dressing for ulcers ; its medicinal properties were examined by Dr. O. Rorke (*Ann. de Thérap.*, 1859, p. 117), who found that in doses varying from 1 to 2 ounces it acted as a mild and sure purgative, producing in from three to six hours, after ingestion, free bilious evacuations, its operation being unattended either by nausea, colic or other ill-effects. (*Phar. of India*, p. 203.) From more recent experiments it appears that half an ounce of the oil is a sufficient aperient. MM. Corre and Lejanne (*Résumé de le Mat. Med. et Tox. Coloniale*) remark :—" There is no doubt that the properties of this oil differ when the oil is prepared in different ways." When cold drawn from the fresh nuts, Heckel, who used it at the Military Hospital at Nouméa, found that it was only purgative in 80 gram doses, that is to say, it simply acted as a fatty oil; he found that the drastic resinous constituents remained in the oil-cake. M. Jugant, at Nosi-Bé, found that the oil extracted by the hot process acted freely as a purgative in 40 gram doses. Many observations were made in the Military Hospital with the result that the oil was found to operate in from 1 to 3½ hours. Dr. Grasourdy considers the oil to equal castor oil in purgative properties. The oil, if intended to be used as a purgative, should be extracted by pressure between hot plates.

Description.—A tree of considerable magnitude, attaining the height of 30 to 40 feet. The leaves are alternate, four to eight inches long, stalked and without stipules, either oval-acute and entire, or from three to five-lobed, and like all the young parts covered with a whitish starry pubescence. The flowers are small and white, growing in clusters at the apex of the branches, the males and females together in the

same cluster, the former being the most numerous. The fruit is 2-celled, fleshy, roundish, and, when ripe, of an olive colour, its greatest diameter about 2½ inches; each cell contains one ovoid somewhat flattened nut, the shell of which is very hard and thick; the kernel is conform to the nut, white and oily.

Chemical composition.—The nuts have been examined by Nallino (*Gaz. Chim. Ital.*, ii., 257), who found the average weight of the husks to be 6·5 grams, of the almonds 3·3 grams. Composition of husks: water, 3·71; organic matter, 89·90; mineral matter, 6·39. Composition of almonds: water, 5·25; fat (extracted by carbon sulphide), 62·97; cellulose and other organic matters, 28·99; mineral matter, 2·79. Composition of the ash of the almond: lime, 18·69; magnesia, 6·01; potash, 11·33; phosphoric anhydride, 29·30. The fatty matter extracted from the almonds by carbon sulphide at ordinary temperatures forms a transparent, amber-yellow, syrupy liquid. When cooled to —10°, it becomes viscous, but neither loses its transparency nor changes colour. According to Brannt, the oil has a specific gravity of 1·940 at 59°F. It consists of an olein resembling linolein, besides myristin, palmatin and stearin. The purgative principle is probably an acrid resin. The oil-cake from Indian and Tahitian seeds has respectively the following percentage composition:—

	Indian.	Tahitian.
Oil	8·93	9·20
Organic matter	74·04	74·24
Ash	8·96	9·36
Water	7·07	7·20

The albuminoids were respectively equal to 52 and 51·7 per cent. (*Brannt.*).

An allied oil (from *Aleurites cordata*) has been examined by Mr. R. H. Davies (*Pharm. Journ.* [3] xv., 636). It is the wood oil of China, and has remarkable drying properties. The specific gravity at 15°·5C. is ·940, and is unaffected by a temperature of —13°C. It required 211 grams of caustic

potash to convert one thousand grams of oil into potash soap. The fatty acids amounted to 94·1 per cent., melting at 39°, containing some white crystalline plates melting at 67°.

CROTON TIGLIUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 239; *Rheede, Hort. Mal. ii.*, *t.* 33. Purging Croton (*Eng.*), Croton cathartique (*Fr.*).

Hab.—China. Cultivated in India. The seeds and oil.

Vernacular.—Jaypál, Jamálgota (*Hind.*), Jaypál (*Beng.*), Nipálo (*Guz.*), Jamálgota (*Mar.*), Nepála (*Can.*, *Tel.*), Nervâlam (*Tam.*), Nirválam (*Mal.*), Kanako (*Burm.*).

History, Uses, &c.—Croton seeds were not known to the ancient Hindu physicians; in recent Sanskrit works they are noticed under the names of Jayapála, Tittiriphala and Kanakaphala, and are described as heavy, mucilaginous and purgative, useful in fever, constipation, enlargements of the abdominal viscera, ascites, anasarca, cough, &c., expelling bile and phlegm. They are directed to be boiled in milk, the outer skin and embryo having been removed, to fit them for internal administration. The following prescription from the Bhavaprakasa may be taken as an example :—

Mahanaracha rasa.—Take Chebulic myrobalans, pulp of *Cassia fistula*, Emblic myrobalans, root of *Baliospermum axillare* (danti), *Picrorhiza Kurrooa* (tikta), milky juice of *Euphorbia neriifolia* (snuhi), root of *Ipomœa Turpethum* (trivrit), and the tubers of *Cyperus rotundus* (mustaka), each one tolá : pound them to a coarse powder, and boil in four seers of water till the latter is reduced to one-eighth. Then take a tolá of husked Croton seeds, tie them in a piece of thin cloth, and boil them in the abovementioned decoction, till the latter is reduced to the consistence of a fluid extract. To this extract add a powder composed of eight parts of purified Croton seeds, three parts of ginger, and two of black pepper, mercury, and sulphur in quantity sufficient to make a pill mass; rub them together for twelve hours, and make into two-grain pills. These are

given with cold water in tympanitis, colic, ascites, &c., as a drastic purgative. After the operation of this medicine, rice should be given with curdled milk and sugar.

The Indian names for Croton seeds lead us to suppose that they were first introduced into the country through Nepal. Under the name of Dand they were known to the Persians at a very early date, and were doubtless introduced into that country from China by the Caravan route through Central Asia. The Arabs retained the Persian name, but also called them Hab-el-khatái, "Cathay seeds," and Hab-el-salátín, "Sultans' seeds." Ibn Sina describes them under the name of Dand-el-sini, "China Dand," and also mentions an Indian Dand of smaller size (probably Baliospermum seeds). Ainslie states that Croton seeds were known to the Arabs under the name of *Fill*, but this is incorrect, as may be seen by referring to Ibn Sina, who describes Fil as an Indian drug having the properties of the Mandrake. Mahometan physicians describe the seeds as detergent, a purgative of phlegm, black bile, and adust humors; and recommend their use in dropsy, calculus, gout, and other diseases arising from cold humors. On account of its irritant action upon the fauces, the seed, after having been boiled in milk, is to be crushed and enclosed in a raisin for administration. The author of the *Makhzan* remarks that the Hindus give small doses with fresh ginger tea, to children, as a remedy for whooping cough. He also notices its irritant action upon the skin, and its use as an external application to tumours, &c.; should excessive purging occur, he directs limejuice to be administered. The envelopes of the seed and plumule must always be rejected. *Croton Tiglium* was first described by Christoval Acosta in 1578, afterwards by Rheede in 1679, and Rumphius in 1743. In 1812, Drs. White and Marshall brought the use of the seeds as a purgative to the notice of Europeans in India. The former gentleman gives the following directions for their administration, which he received from a learned Parsee Vaidia of Surat:—"After having removed the shells from the seeds, tie the kernels in a small piece of cloth, like a bag; then put this into as much

cowdung water as will cover the bag, and let it boil; secondly, when boiled, split the kernels in two and take a small leaf from them, which is said to be poisonous; and thirdly, pound the whole into a mass, to which add two parts of Katha (catechu), and divide into pills of two grains each, two of which are sufficient for one dose." The addition of the Katha is said to correct the acrimony of the drug, and to prevent any griping of the bowels.

Ainslie (*Mat. Indica*, Vol. I., p. 105) notices the use of the expressed oil (nervalum unnay) by the Tamils as an external application in rheumatic affections, but it does not appear to have been used for internal administration until the year 1821. (*Confer. London Medical Depository for January* 1822.)

In modern European medicine, croton oil, more or less diluted, is used externally as a counter-irritant, and causes an abundant pustular eruption. This effect is increased by the addition of an alkali to the liniment. Internally it is given in doses of ½ to 1 minim as a purgative, and is particularly valuable in those cases in which the condition of the patient prevents him from swallowing; it may be placed on the back of the tongue. The oil has also been used with success as an anthelmintic. In modern pharmacy its chief consumption is in the preparation of castor oil capsules.

Description.—Croton seeds (*graines de Tilly*) are oblong, about half an inch long, and not quite ⅜ of an inch broad. The dorsal and ventral surfaces are arched, the former more prominently than the latter. The testa is black, but covered for the most part by a thin cinnamon-coloured membrane; it is thin and brittle, and contains an abundant oily albumen enclosed in a delicate white membrane (endopleura). Between the two halves of the albumen are two foliaceous cotyledons, and a short thick radicle. The structure of these parts closely resembles that of the albumen and embryo of *Ricinus communis.*

Chemical composition.—The fats present in croton oil are glycerides of stearic, palmitic, myristic, and lauric acids, and of several volatile acids of the same series, like acetic, butyric, and

valerianic acid; also the volatile *tiglinic acid*, $C^5H^8O^2$, which was recognized by Geuther and Frölich (1870), but had previously been observed by Schlippe (1858), who considered it to be identical with angelicic acid. However, it melts at 64° C., boils at 198·5° C., and is identical with Frankland and Duppa's methylcrotonic acid. In the fraction boiling above the temperature named, capronic, œnanthylic, or similar acids are probably present. They did not succeed in obtaining from croton oil an acid having the composition of Schlippe's *crotonic acid*, $C^4H^6O^2$. E. Schmitt (1879) corroborated these statements, and found among the volatile acids also formic acid. Schlippe's *crotonol*, $C^{18}H^{28}O^4$, has likewise not been obtained by other chemists; it was stated to be a yellowish viscid mass of a faint odour, and to be the rubefacient principle of croton oil. The drastic rubefacient properties, according to Buchheim (1873), reside in *crotonoleic acid*, which is present in the free state and as glyceride, and which seems to be related to ricinoleic acid, since, like the latter, it yields with nitric acid œnanthic acid, and on the distillation of its sodium salt gives œnanthol. (*Stillé and Maisch.*)

H. Senier (*Pharm. Journ.* [3], XIV., 446, 447) has shown that when alcohol (sp. gr. ·794—·800) is mixed in equal volumes with English pressed croton oil, perfect solution takes place, the mixture being permanent at all ordinary temperatures, and this is equally true when any less quantity of alcohol is used; when, however, the proportion of alcohol to croton oil becomes as seven volumes to six, or any larger proportion of alcohol, then a part of the croton oil separates. This part varies in quantity in the case of different samples of oil. That part of the croton oil which separates when the alcohol is in excess is afterwards insoluble in any proportion of alcohol. But that portion of the oil dissolved by alcohol is, when separated, soluble in all proportions. The author has shown that the part of croton oil soluble in alcohol contains the vesicating principle, while the portion insoluble in alcohol is entirely non-vesicating. He also shows that the purgative properties of croton oil reside entirely in this insoluble,

non-vesicating part. The author has endeavoured to ascertain to what constituent of the soluble portion of the oil the vesicating properties are due, and has traced these properties to the non-volatile fatty acids, chiefly to those which have the lowest melting points, are least readily saponified by alkalies, and are first liberated when the alkali soap is decomposed by acids. He attributes the purgative action not to the free acids, but to the combination in which they exist in the oil.

These conclusions not appearing satisfactory to Professor Kobert, the investigation was taken up by Herr von Hirschheydt, a pupil in the University of Dorpat. Upon the basis of the results obtained, Professor Kobert now (*Chem. Zeit.*, April 6, 1887, p. 416) attributes the activity of croton oil, both as a vesicant and as a purgative, to crotonoleic acid, not to be confounded with crotonic acid, but an acid discovered by Buchheim in 1873, to which a formula has not yet been assigned. This crotonoleic acid is said to occur in croton oil both in the free state, in which it is freely soluble in alcohol, and in combination as a glyceride. The glyceride does not possess poisonous properties, but the free acid acts as a powerful irritant to the skin and the intestines (purgative). According to Professor Kobert, the crotonolglyceride is attacked and split up like other glycerides by the ferments of the juices of the stomach, and the crotonoleic acid being set free then exercises its purgative influence. A similar result may be obtained by administering crotonoleic acid as a pill enclosed in keratin. Kobert is not of opinion, however, that the solubility of croton oil is dependent upon the proportion of crotonoleic acid it contains, but considers it to be connected with the age of the oil. Crotonoleic acid may be prepared by treating the portion of croton oil soluble in alcohol with a hot saturated solution of baryta in a water-bath, washing the stiff white paste that forms with cold distilled water to remove excess of baryta, and barium compounds with acetic, butyric and tiglinic acid, removing by heat traces of water, and repeatedly treating with ether, which only takes up the barium oleate and crotonoleate. The crotonoleate is separated by dissolving it out in alcohol,

decomposed carefully with sulphuric acid, and the solution containing the free acid evaporated. (*Pharm. Journ.*, April 30th, 1887.) According to Dr. H. Stillmark, croton seeds contain *Ricin*, the poisonous principle of castor seeds. (*See Ricinus.*)

Toxicology.—The seeds are said to be used in Java for killing fish, and the oil has been shown to have the same effect upon the carnivora as upon man. When eaten, the seeds cause nausea and eructation, followed by flatulent distension of the abdomen, colic and diarrhœa. A single seed is reported to have proved fatal. The oil, in the dose of 1 drop, occasions more or less of an acrid and burning sensation in the fauces and œsophagus, a sense of warmth in the stomach, nausea, and sometimes vomiting. In an hour or two, some gurgling or slight colic is perceived in the bowels, followed somewhat suddenly by a watery stool with tenesmus, and heat about the anus. Within 24 hours eight or ten more stools follow, and there is but little general disturbance of the economy, except considerable weakness. Sometimes, instead of producing evacuations, the oil causes epigastric uneasiness and oppression, palpitation of the heart, headache, feverishness, perspiration, and sleep. It would appear that the acrid principle of the oil is not the sole cause of its cathartic operation, for even after being thoroughly washed with alcohol and rendered mild to the taste, as well as incapable of pustulating the skin, it is still strongly purgative. (*Stillé and Maisch.*) No cases of poisoning by croton seeds or oil in India appear to have been recorded.

During the expression of croton oil in India, the workmen, who are naked, with the exception of a cloth round the loins, have been observed to suffer from redness and irritation of the skin, evidently produced by some volatile constituent of the oil.

CROTON OBLONGIFOLUS, *Roxb.*

Hab.—Bengal, Silhet, Behar, Central India, Deccan Peninsula, Burma, and Ceylon. The root-bark, leaves, and fruit.

Vernacular.—Chucka, Barágach (*Beng.*), Arjuna (*Hind.*), Kote, Putol (*Mal.*), Bhutan-kusam (*Tel.*), Ghanasura (*Mar.*), Gote (*Santal*), Kurti, Konya, Kuli, Poter (*Kol.*), Gonsurong (*Goa*).

History, Uses, &c.—Brandis has noticed the use of the bark, leaves and fruit of this plant in native medicine, and Dr. Irvine the use of the seeds as a purgative. From the *Dict. Econ. Prod. of India* we learn that the Santals use the bark and root as a purgative and alterative. We have been unable to find any notice of the drug in native works on Indian Materia Medica. Roxburgh, though he describes the tree as common in forests near Calcutta, is silent upon the subject. Dalzell and Gibson, in the *Bombay Flora* (p. 231), remark that "the plant is used medicinally by the natives to reduce swellings." The author of the *Mat. Med. of West. India* remarks :—"When on a visit to Goa in 1876, my attention was drawn by the native doctors to the root-bark of a small tree as being one of the most valuable medicines they possessed; this plant, unknown to me at the time, proved on subsequent investigation to be *C. oblongifolius*. The Goanese and inhabitants of the Southern Concan administer the bark in chronic enlargements of the liver and in remittent fever. In the former disease it is both taken internally and applied externally. As an application to sprains, bruises, rheumatic swellings, &c., it is in great request. In large doses it is said to be purgative." Flückiger and Hanbury (*Pharmacographia*, p. 510) state that the seeds are said to be sometimes substituted for those of *C. Tiglium*. The tree is rare in the Bombay Presidency, and has only been found in the Southern Concan, where it has a reputation as a remedy in snake-bites. In Goa it is more common.

Description.—Trunk straight; bark ash-coloured, and pretty smooth; leaves petioled, alternate, and thickly set about the ends of the branchlets, spreading or drooping, oblong, serrate, obtuse-pointed, very smooth on both sides, from six to twelve inches long, petioles round and smooth, with a lateral gland on each side of their apices; stipules small, caducous;

racemes terminal, generally solitary, erect, shorter than the leaves; flowers solitary, a few female ones mixed with many male ones, small, of a pale yellowish-green; bracts 3-fold, one-flowered, on the inside of each of the small lateral bracts is a round permanent gland, as in *Sesamum indicum*; male calyx deeply 5-cleft, petals six, smaller than the calyx, very woolly; filaments twelve, distinct, nine in the circumference and three in the centre, woolly towards the base; female calyx and corol as in the male; stamens none; germ globular; styles three, each divided into two very long, variously bent segments; capsules globular, fleshy, six-furrowed, tricoccous. (*Roxb.*)

The root is twisted, often somewhat flattened, bark thickish, externally light-brown and scaly, internally yellowish, mottled with brown, substance compact and resinous, odour highly aromatic, taste peppery and camphoraceous. Wood white, soft.

Microscopic structure.—Sections of the bark show that the epidermis consists of about five rows of elongated cells placed horizontally; their walls are much thickened by a dark-brown deposit, which produces a patchwork appearance. The parenchyma is loaded with large globular or oval highly refractive bodies of a yellowish colour; there are also numerous dark purplish-brown particles, which are sometimes single but usually arranged in irregular concentric rows; they appear to be due to a deposit in the vascular system of a resinous nature.

Chemical composition.—The fresh root-bark was contused, and exhausted with warm 80 per cent. alcohol. The tincture was of a red colour. The alcoholic extract was mixed with water and agitated with petroleum ether, when reddish flocks separated. The solution was acid in reaction. The petroleum ether solution left on spontaneous evaporation a transparent viscid yellow residue, possessing a camphoraceous and pepper-like odour and taste. With the exception of some white flocks, the extract was soluble in cold alcohol with acid reaction; the solution afforded no coloration with ferric chloride.

The turbid aqueous solution, after separation of petroleum ether, was agitated with ether, without solution of the reddish

flocks referred to as having separated on agitation with petroleum ether. The ether was separated from the turbid aqueous layer, and agitated with dilute sulphuric acid to separate any alkaloidal principle. The acid aqueous solution was then rendered alkaline and reagitated with ether. The ethereal solution left on spontaneous evaporation a slightly greenish transparent varnish-like residue, partly soluble in dilute sulphuric acid, the solution affording marked alkaloidal reactions. With Fröhde's reagent a dirty red to purple colour was observed, but no other special colour reactions were noted.

The original ethereal solution, after the agitation with sulphuric acid, left on spontaneous evaporation a brittle, transparent, yellow residue, soluble in alcohol with strong acid reaction, but affording no colour reaction with ferric salts. By the action of dilute aqueous caustic soda a part of the ethereal extract was dissolved with a deep port-wine red coloration. The portion insoluble in the alkaline solution was yellowish. The alkaline solution, on the addition of dilute acids, afforded yellow flocks, nearly wholly soluble in ether, and leaving a transparent yellow varnish on spontaneous evaporation, with a slightly bitter taste and acid reaction in alcoholic solution. The reddish flocks insoluble in petroleum and ordinary ether were separated from the original aqueous solution, and, when dry, formed a dirty reddish friable mass without taste or odour. In dilute alcohol this principle was soluble with acid reaction, the solution being of a port-wine colour, and possessing a slight spicy odour and taste. The solution, after being neutralized with ammonia, which deepened the tint, afforded a dirty plum-coloured precipitate with acetate of lead. To the original now clear aqueous solution of the alcohol extractive carbonate of soda was added, which caused a carmine-coloured precipitate, and the liquid agitated with ether, which failed to dissolve the precipitate. The ethereal solution left on evaporation a trace of residue, partly soluble in dilute suphuric acid, the acid solution reacting with alkaloidal reagents. With Fröhde's reagent the colour was dirty red to purple, and, like the principle first extracted by

ether from the acid aqueous solution, yielding no other special colour reactions. The carmine flocks precipitated by the alkali, and which were insoluble in ether, were separated by filtration, the filtrate being of a logwood colour, and washed with cold water in which they were slightly soluble: on ignition an alkaline ash was left. By dilute acids the carmine precipitate was changed to salmon-yellow, the original colour being restored by alkalies. An aqueous solution gave a carmine-coloured precipitate with acetate of lead.

The original aqueous alkaline solution was lastly acidified with dilute sulphuric acid, which caused the separation of salmon-coloured flocks, and agitated with amylic alcohol. The amylic alcohol extract was reddish-yellow, becoming of a deep carmine hue with alkalies, and afforded a carmine precipitate with acetate of lead; acids destroyed the colour and caused a precipitate of salmon-coloured flocks practically insoluble in ether. By heating with zinc dust, the dried principles, which gave coloured precipitates with alkalies and acetate of lead, afforded no crystalline sublimates. The freshly contused root-bark afforded on steam distillation a small amount of a colourless volatile oil possessing a marked camphoraceous and pepper-like odour and taste.

In this investigation the principles which afforded coloured precipitates with alkalies were the most interesting, and these principles would appear to have been acids. It will be noted that the original aqueous solution of the alcoholic extract was not treated with any foreign acid prior to agitation with petroleum and ordinary ether. The flocks which separated during agitation with petroleum ether, and which were insoluble in ether, gave from an alcoholic solution a different coloured precipitate with acetate of lead, from the acids which were subsequently precipitated when the aqueous solution of the extract was rendered alkaline and agitated with ether, and when the alkaline solution was subsequently acidified before agitation with amylic alcohol. The last two acids referred to were, we consider, identical. The sodium salt of the acid was only slightly soluble in water, while the free acid was at best

only slightly soluble in ether. The addition of sodic carbonate hence caused the precipitation of the greater part of the sodium salt, a small amount only remaining in solution. The subsequent addition of sulphuric acid decomposed the sodium salt in solution, with separation of the free acid in salmon-coloured flocks. As regards the identity of this acid with the one or ginally separated on agitation with petroleum ether, and ether, though the colour of the lead salt was different, it might have been due to the presence of foreign matters, and we are inclined to the view that these acid principles were similar. The alkaloidal principle from the first ether extract, and that obtained from the alkaline ether, were also probably identical.

ACALYPHA INDICA, *Linn.*

Fig.—*Wight Ic., t.* 877; *Rheede, Hort. Mal. x., t.* 81.

Hab.—Hotter parts of India.

ACALYPHA PANICULATA, *Miquel.*

Fig.—*Rheede, Hort. Mal. x., t.* 83.

Hab.—Deccan Peninsula. The herb.

Vernacular.—Kuppi, Khokali (*Hind., Mar.*), Dádaro (*Guz.*), Muktajuri, Shwet-basanta (*Beng.*), Kuppaimeni (*Tam.*), Kuppai-chettu, Murkanda-chettu, Puppanti, Harita-manjari (*Tel.*), Chálmári, Kuppi (*Can.*), Kuppa-mani (*Mal.*)

History, Uses, &c.—The medicinal properties of these plants are well known in India, but we have been unable to find any notice of them in the standard Sanskrit medical works.

Ainslie gives Aritamunjayrie as the Sanskrit name, which is evidently meant for Harita-manjari, "a plant with clusters of green flowers," a very appropriate name. Rheede describes two species of *Acalypha*, Cupameni (*A. indica*), and Wélia-cupameni (*A. paniculata*); he gives Manjara-sejári as the brahminical name of the first, and states that the juice, made into a liniment with oil, is used in rheumatism and venereal pains and eruptions, and, with the addition of lime, in skin diseases; that

the root rubbed down with hot water is given as a cathartic; the leaves with water as a laxative, and in decoction to relieve the pain of earache. Of the second, he says that when rubbed down in rice-water and applied locally, it relieves pain, and that the juice with sesamum oil is useful in erysipelatous inflammation, hæmorrhoids, and the pain in the belly called by the Malabars *Guinao.* Ainslie says of *A. indica*:—"The root, leaves and tender shoots are all used in medicine by the Hindus. The powder of the dry leaves is given to children in worm cases, also a decoction of them with the addition of a little garlic. The juice of the same part of the plant, together with that of the tender shoots, is occasionally mixed with a small portion of margosa oil, and rubbed on the tongues of infants for the purpose of sickening them and clearing their stomachs of viscid phlegm. The hakims prescribe the Koopamaynee in consumption." In the *Pharmacopœia of India* (p. 205), the following reference to this plant by Dr. G. Bidie, of Madras, will be found:—"The expressed juice of the leaves is in great repute, wherever the plant grows, as an emetic for children, and is safe, certain, and speedy in its action. Like Ipecacuanha, it seems to have little tendency to act on the bowels or depress the vital powers, and it decidedly increases the secretion of the pulmonary organs. The dose of the expressed juice for an infant is a teaspoonful." Dr. Æ. Ross speaks highly of its use as an expectorant, ranking it in this respect with senega; he found it specially useful in the bronchitis of children. The purgative action of the root noticed by Rheede is confirmed by Dr. H. E. Busteed, who has used it as a laxative for children. In Bombay the plant has a reputation as an expectorant, hence the native name Khoklí (cough). Brigade-Surgeon Langley, in a communication to Dr. Watt, *Dict. Econ. Prod. Ind.*, Vol. I., writes:—"This plant is called in Canara *Chálmári* as well as Kuppi. The natives use it in congestive headaches: a piece of cotton is saturated with the expressed juice and inserted into each nostril; this relieves the head symptoms by causing hæmorrhage from the nose. The powder of the dry leaves is used in bedsores and wounds attacked by worms. In asthma

and bronchitis I have employed it with benefit both for children and adults." Dr. Langley recommends a tincture of the fresh herb made with spirits of ether (3 ozs. to one pint), dose 20 to 60 minims, frequently repeated during the day, in honey; it acts as an expectorant and nauseant; in large doses it is emetic.

Description.—*A. indica.*—Stem erect, from 1 to 2 feet high, branchy, round, smooth; leaves scattered, petioled, ovate-cordate, 3-nerved, serrate, smooth, about 2 inches long and 1½ broad; petioles as long as the leaves; stipules small, subulate; spikes axillary, generally single, peduncled, erect, as long as the leaves, many-flowered, crowned with a body in the form of a cross, the base of which is surrounded with a 3-leaved calyx, the arms of the cross are tubular, with their mouths fringed, from the base of the cross on one side issues a style-like thread, with a fringed stigma, the body of the cross contains an ovate seed like substance; male flowers numerous, crowded round the upper part of the spike, calyx 4-leaved, leaflets cordate, filaments minute, numerous; female flowers below the male, remote; involucre cup-formed, with an opening on the inner side, striated, smooth, toothed, from 2 to 4-flowered; calyx 3-leaved. (*Roxb.*).

A. paniculata is a pubescent under-shrub or herb, with long-petioled ovate-acuminate leaves which are coarsely and equally serrated. The male flowers are in axillary, filiform spikes, and the female in axillary and terminal racemes or panicles; the bracts are minute and not enlarged in fruit. Capsule 1¼ inch in diameter, 3-lobed, glandular, styles 3—7-partite.

Chemical composition.—The whole plant of *A. Indica* was dried at a low temperature, reduced to powder, and exhausted with 80 per cent. alcohol. The alcoholic extract was mixed with water, acidulated with sulphuric acid, and agitated with petroleum ether, and ether; the solution was then rendered alkaline and agitated with ether. During agitation with petroleum ether, a quantity of dark matter separated, which was partly soluble in ether, and in alkalies, and contained much colouring matter. The petroleum ether extract was dark and viscid, and had an

aromatic odour, but did not yield any crystalline deposit on standing: in absolute alcohol it was soluble, and on spontaneous evaporation some yellow matter separated, which was destitute of crystalline structure on microscopic examination. The alcoholic solution had no special taste. The ether extract was yellow, and had an aromatic somewhat tea-like odour, and on standing became indistinctly crystalline. In warm water a portion dissolved, the solution possessing a strong acid reaction, and affording a dirty reddish coloration with ferric chloride: it did not precipitate gelatine, and gave no reaction with cyanide of potassium. The portion insoluble in water was dissolved by ammonia, affording a deep yellow coloured solution with a somewhat camphoraceous odour, the addition of acids causing the precipitation of whitish flocks.

The ether extract obtained from the original aqueous solution, after it had been rendered alkaline, contained a well-marked alkaloidal principle, which after purification afforded the following reactions: with Fröhde's reagent pinkish in the cold, dirty blue on warming; with sulphuric acid yellowish-red; no reaction with sulphuric acid and potassium bichromate; no reaction with ferric chloride; with nitric acid a yellow coloration; it was not precipitated by chromate of potash from an aqueous solution acidulated with sulphuric acid; taste harsh, without bitterness. We propose provisionally to call this principle *Acalyphine.*

Ainslie notices the use of **A. fruticosa**, Forsk., as a stomachic and alterative, an infusion of the leaves being used. (*Mat. Ind.*, ii. 388.)

TREWIA NUDIFLORA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1870—1; *Baill. Étud. Gen. Euphorb.*, *t.* 18; *f.* 18—23; *Rheede, Hort. Mal. i.*, *t.* 42.

Hab.—Hotter parts of India. The root.

Vernacular.—Pindára, Túmri, Bhilaura (*Hind.*), Pitáli (*Beng.*), Pitári, Sivani (*Mar.*), Kát-kumbla (*Can.*), Kánchi (*Mal.*).

History, Uses, &c.—This tree bears the Sanskrit names of Pindára, Karaháta, and Kurangaka. It is described in the Nighantas as sweet and cooling, useful for the removal of swellings, bile and phlegm; the root is prescribed in gouty or rheumatic affections. Rheede describes the plant under the name of *Canschi*, and states that the root in decoction is used to relieve flatulence, and is applied locally in gout.

Description.—The root has a thickish bark, which is of a light-brown colour externally, nearly smooth, and studded here and there with a few small lenticular corky worts. On rubbing off the thin brown suberous layer a dull-red surface is exposed. The bark is fibrous and tough, and has a subaromatic, astringent and slightly bitter taste. The wood is white and soft.

Chemical composition.—The fresh root-bark was contused and exhausted with 80 per cent. alcohol; the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated successively with petroleum ether, and ether; then rendered alkaline with sodic carbonate and agitated first with ether and lastly with amylic alcohol.

During agitation with petroleum ether a large amount of resinous matter separated. The petroleum ether extract contained a large amount of colouring matter and had a persistent bitter taste. By agitation with water acidulated with sulphuric acid and ether, it was separated into two portions, a portion soluble in ether, which contained the greater part of the colouring matter, and some fat; while the aqueous acid solution held in suspension yellowish flocks consisting of a neutral resinous principle.

The acid ether extract was small in amount, partly soluble in water with acid reaction; the solution giving a blue-black coloration with ferric chloride, and precipitating gelatine, but giving no reaction with potassium cyanide. On adding ammonia to the ether extract, a yellow to brown sherry colour was produced. The ammoniacal solution was agitated with ether, which removed a small amount of whitish resinous

matter, insoluble in water and containing no alkaloidal principle. The ammoniacal solution contained resinous matter.

The alkaline ether extract contained traces of an alkaloid, which, after purification, gave a very faint-yellow coloration with Fröhde's reagent in the cold, the colour becoming faintly greenish on warming; concentrated nitric acid gave a slight yellow coloration.

The amylic alcohol extract contained some resinous matter, and an alkaloidal principle in larger amount than was present in the ether extract, but which we consider to be identical.

The resinous matter which separated on originally shaking the alcoholic extract with petroleum ether, and which was insoluble in it, also failed to dissolve in ether; it was also insoluble in aqueous sodic carbonate, and had the properties of phlobaphene.

MALLOTUS PHILLIPPINENSIS, *Müll-Arg.*

Fig.—*Bentl. and Trim., t.* 236; *Bedd. Fl. Sylv., t.* 289; *Roxb. Cor. Pl. ii., t.* 168; *Rheede, Hort. Mal. v.*, 21, 24.

Hab.—Throughout Tropical India. The glands and leaves.

Vernacular.—Kapála, Kamála (*Hind.*), Kamila (*Beng.*), Kapila, Kapita, Kamila (*Mar.*), Vasáré, Chandrahittu (*Can.*), Kámpilla (*Guz.*), Kapli, Kapila (*Tam.*), Kápila-pod (*Tel.*).

History, Uses, &c.—The glandular powder obtained from this plant has been used as a dye in India from a very remote period. It was probably collected, as at the present time, by the aboriginal tribes, who call it *Ruhin*, before the Hindus invaded India. In Sanskrit it is known as Kampilla, and bears the synonyms of Rochanika, Rochana-rakta and Lohita-rakta, in allusion to its red colour. In the Nighantas it is described as useful in removing phlegm, bile, stone, worms, enlarged glands, boils, &c., and the leaves are said to be astringent and cooling. In the *Bhavaprakása* one tola with treacle is said to kill and expel all intestinal worms. It

is also prescribed for worms in combination with the seeds of *Embelia Ribes* (vaverang), chebulic myrobalans, carbonate of potash, and rock salt. (*Chakradatta.*) The Arabs became acquainted with Kampilla at an early date, and through them it appears to have reached Europe, and to have been known to the later Greek physicians about the 7th century. Ibn Massowiyeh, physician to the Caliph Haroon-el-Raschid, speaks of it as highly astringent, a good anthelmintic, and a useful application to moist eruptions of the skin, which it soon dries up. It is also mentioned by Rázi, Tamimi, Baghdádi, Ibn Sina, Ibn Baitar and others, all of whom appear to have been in much doubt as to its nature, but distinguish it from *Wars*, a product of Arabia, the source of which they were acquainted with. Ibn Sina says of Kanbíl:—"It is in grains like sand, red, but less so than *Wars*, hot and dry in the third degree; Ibn Massowiyeh considers to be highly astringent; it kills worms and flukes of the intestines and expels them." Of *Wars*, he says:—"It is a substance like powdered saffron, of an intense red colour (احمر قانى), brought for sale from Yemen; they say that it is scraped from a plant; it is hot and dry in the third degree, astringent; a useful application to pimples, freckles, &c." (A number of skin eruptions are named, the exact nature of which is doubtful.)

The author of the *Makhzan*, who wrote in India (1770), is strangely ignorant of the source of this drug. He says:—"Kinbíl is an Arabic form of the Persian Kampilla and Hindi Kamila"; he then recapitulates the various opinions held as to the source of the drug, and concludes by saying: "I have heard that it is the pulp of the fruit of a mountain-tree like the *Ma'asfar*, but its leaves are rather larger, and it is armed with long stiff thorns, and has fruit like a lime, which is green when young and red when ripe; when ripe it bursts open and a dull-red substance escapes and falls on the ground: this is collected, and is Kinbíl." Regarding its properties, he says that in doses of from 1 to 2 dirhems rubbed into an emulsion with any suitable vehicle it expels all kinds of intestinal worms, and at the same time acts as a purgative. Speaking

of *Wars*, the same author says that there is a black kind, which comes from Ethiopia, and is called '*Habshi*,' and a dull-red kind which is called Indian, and is the worst (as a dye); he concludes by saying the seeds of the *Wars* are like Másh (*Phaseolus radiatus*). There is no mention of its use as an anthelmintic; it is described as an aphrodisiac, lithontriptic, and remedy for ringworm, pityriasis and freckles. Sprengel thought that the source of *Wars* was *Memecylon tinctorium.* (Confer. *Hist. Med.*, *t.* II., p. 444, ed. tert.; also *Hist. rei Herb.*, *t.* I., p. 258.)

Rheede first figured and described the plant; he states that the leaves, fruit and root with honey are applied to poisoned bites, bruises, &c. Buchanan (*Journey through Mysore in* 1801) notices Kamála; it has also been noticed by Ainslie, Roxburgh, and Royle, but Mackinnon of Bengal, in 1858, was the first to introduce it into European practice in India; since then it has been used with success by many medical men in India and Europe. Previous to this, Vaughan had sent Kamála to Hanbury from Aden under the name of *Wars*, and had described its use as a dye, and as a remedy in certain skin diseases. (*Pharm. Journ.*, Vol. xii., p. 386, 1853.) The true Arabian *Wars* does not appear to have attracted attention in Europe until 1867, when it was imported by Messrs. Allen and Hanburys of London. The source of *Wars* remained unknown until 1884, when it was ascertained to be the glands of the pod of *Flemingia Grahamiana*, a leguminous plant common in Arabia and India. (*See Flemingia.*)

As noticed in the *Pharmacographia*, the names Kanbíl and Kamála are not in use in the bazars at Aden; the Indian Kamála being now commonly known there as *Wars*.

The dose of Kamála is from one to two drachms, or one to three fluid drachms of a saturated tincture may be employed; it does not cause much nausea, colic, or purging. The parasite is generally discharged dead, and it appears to be equally efficacious in removing all kinds of worms. The dose should be repeated several times at intervals of about three hours.

Description.—Kamála is a red powder, which varies in depth of colour, mixed with it are greenish-yellow fragments of the capsule of the plant; like lycopodium it is inflammable and resists admixture with water. Alcohol and ether dissolve a considerable portion of it, and the solution poured in water emits a melon-like odour.

Microscopic structure.—Each grain of Kamála is a spherical body, consisting of an outer delicate membrane within which may be seen a structureless mass of yellow colour, in which are embedded numerous club-shaped cells, arranged with their thick ends outwards; in order to examine these cells the drug must be exhausted of its resin by alcohol or potash. The hairs which are found mixed with the glands are stellate, each hair being one-celled and thick-walled.

Chemical composition.—Pure Kamála contains only between ·5 and 3·5 per cent. of moisture, and yields to ether, alcohol, amyl alcohol, glacial acetic acid, or carbon disulphide, about 80 per cent. of resin, which is also soluble in alkalies, but not in benzine, and whose alcoholic solution is coloured dingy-green by ferric chloride. (*Flückiger.*) Leube (1860) analyzed a sample of Kamála which yielded nearly 29 per cent. of ash, 47·6 of resin, and 19·7 of other soluble matters, consisting of citric, oxalic, and tannic acids, gums, &c. Cold alcohol dissolved a resin, $C^{15}H^{18}O^{4}$, fusible at 80° C., and left a more sparingly soluble resin, $C^{8}H^{14}O^{5}$, melting at 191° C. Both resins are brittle, reddish-yellow, soluble in alkalies with a red colour, not altered by dilute acids, and when treated with nitric acid yield oxalic acid. Leube could not obtain Anderson's *Rottlerin*, $C^{11}H^{10}O^{3}$ or $C^{22}H^{20}O^{6}$ (1855), which crystallized from the concentrated ethereal tincture in yellow silky needles. Groves (1872) ascertained that it is easily modified by exposure to air, and is consequently obtained only from the recent drug. Flückiger subsequently observed that on being fused with potassa, rottlerin yields *paraoxybenzoic acid.* Anderson's *resinous colouring matter* has the compositiom $C^{30}H^{30}O^{7}$, melts at 100° C., is easily soluble in alcohol and ether, and yields with lead acetate

an orange-coloured precipitate. By treating Kamála with boiling alcohol, and cooling, amorphous floccules of the composition $C^{20}H^{34}O^{4}$ are obtained, which are sparingly soluble in cold alcohol and ether, and are not precipitated by lead or silver salts. (*National Dispensatory.*)

Messrs. A. G. Perkin and W. H. Perkin, Junr. (*Berichte*, 1886), have recently separated from Kamála a substance which they name *Mallotoxin*, $C^{11}H^{10}O^{3}$ or $C^{18}H^{16}O^{5}$. It was obtained by shaking powdered Kamála with bisulphide of carbon, evaporating the solution, and treating the residue with just enough bisulphide of carbon to remove the resinous impurities. It was finally purified by crystallization from benzine or toluene. It formed small flesh-coloured needles, soluble in alkalies, alcohol and acetic acid, but insoluble in water. It appears to be identical with the rottlerin of Anderson. Later still, L. Jarvein (*Ber.*, xx., 182) obtained a yellow crystalline substance from Kamála, melting at 200°, to which he gave the same name and formula as Anderson's rottlerin.

The bark of this tree is astringent, and Professor Hummel found it to contain 6·5 per cent. of tannin.

Carefully selected, Kamála, according to P. Siedler, will not contain more than 1·5 per cent. of ash, whilst the commercial article yields from 21·8 to 49·1 per cent. By sifting, fractions may be obtained containing as low as 5·2 and as high as 25 per cent. High percentage of mineral matter may be due to careless collection, or to adulteration; in the latter case, the ash may range from 50 to 80 per cent. The percentage of ash has notably increased of late, and by sifting it is often impossible to get the drug containing less than 14 per cent. of ash. Of 45 samples examined by the author, only three contained less than 6 per cent. (*Pharm. Zeitg.*, 1891, 162.)

Commerce.—Kamála is collected in the N.-W. Provinces, the Concan and Madras, and is distinguished by the collectors as of two qualities, *Kapila* and *Kapili*; the latter is the best, and is obtained by shaking the fruit only in a basket to separate the glands. Kapila consists of the glands and other parts of the

plant, and has a greenish tinge. The collection of the drug is an industry of the hill Khonds in Ganjam, who sell a few measures for a few measures of rice or a yard of cloth.

The average value of the best red Kamála is Rs. 11 per maund of 41 lbs. The high winds laden with dust, which often prevail in India, cause a certain amount of impurity in the drug from the adherence of dust to the capsules and leaves of the plant. Native dealers test the drug by taking it up on the moistened finger and rubbing it firmly upon a piece of white paper; if of good quality, a smooth paste is formed and the paper is stained of a bright-yellow colour.

RICINUS COMMUNIS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 237; *Sibth. Fl. Græc. x.*, *t.* 952; *Hayne, Arneigew. x.*, *t.* 48; *Rheede, Hort. Mal. ii.*, *t.* 32. Castor plant (*Eng.*), Ricin commun (*Fr.*).

Hab.—Africa? Cultivated throughout India. The leaves, seeds, root, and oil.

Vernacular.—Arandi (*Hind.*), Erandi (*Mar.*), Bherenda (*Beng.*), Amanakkam-chedi (*Tam.*), Amudapu-chettu (*Tel.*), Avanakku (*Mal.*), Karala-gida (*Can.*), Erando (*Guz.*).

History, Uses, &c.—The Castor plant is called in Sanskrit Eranda, Ruvu, Ruvuka and Uruvuka, and the red variety Raktairanda; the root and the oil obtained from the seeds have been used medicinally by the Hindus from a very remote period, and are mentioned by Susruta.

Both root and oil are described as purgative and useful in costiveness, flatulence, rheumatism, fever and inflammatory affections; on account of its efficacy in rheumatism the plan bears the synonym of Vátári (váta-ári). As a purgative the oil is directed to be taken with cow's urine or an infusion of ginger or the decoction of the ten roots known as *dasamula* (see Vol. I., p. 243). The seeds freed from the husks and germs, and boiled in milk and water, form a decoction which is given in rheumatism; a decoction of the root with carbonate of potash

is also prescribed, and most compound medicines given in rheumatic and neuralgic affections contain the root. The leaves are applied to the breast to stop the secretion of milk, and, boiled with the root in goat's milk and water, they are used as a local application in ophthalmia. When applied to the abdomen they are popularly thought to promote the menstrual flow; in *Govardhana* (203), the *halikavadhu*, or "peasant woman," is represented as lying in pain upon the leaves of the *Eranda.*

In the proverbial language of the Indians the Castor plant is emblematic of frailty; they say:—Naukri arand ki jar hai (service is like the root of the Castor plant). The Arabs appear to have first become acquainted with the tree in India, as they call the seeds Simsim-el-hindi, "Indian Sesamum," and the plant Khirvaa (خروع), a word which signifies any weak or frail plant; the properties they attribute to it are also those mentioned by Sanskrit writers. Again, in the *Saptasataka* of Hála, we find the large and swelling breasts of the peasant girl likened to the Eranda leaf, and in Arabic we have the expression امراة خروعة applied to a beautiful and tender girl.

R. communis is the Bidanjir and Kinnatu of the Persians; it also bears various local names, such as Gerchak in the Shahpur District, and Buzanjir, "goat's fig," in Khorasan.

Aitchison notices its cultivation round the borders of fields in the latter province, and in the Harirud District, for the sake of the oil which is used as a lamp oil, and says that the peasantry are unacquainted with its purgative properties. The plant was cultivated in Southern Europe at a very early date; it is the κίκι of Herodotus, the κρότων of Theophrastus (H.P.i.,16; C.P. ii.), and the κίκι or κρότων of Dioscorides (iv., 158), who observes that the name κρότων is given to the seed on account of its resemblance to an insect known by that name (*Ixodes Ricinus*, Latr.). He also notices Castor oil and its medicinal use. It is the Ricinus or Cicus of Pliny (15, 7), "a tree which grows in Egypt in great abundance; by some it is known as croton, by others as sili, and by others, again, as wild sesamum: it is

not so very long since this tree was first introduced here. Eaten with food the oil is repulsive, but it is very useful for burning in lamps."

The Jews and Abyssinian Christians say that it was under this tree that Jonah sat, but in the English version the Hebrew word "*Kikajon*" is translated "gourd." For a history of the plant in Europe, the *Pharmacographia* may be consulted.

Mahometan medical writers describe two kinds, red and white: the red is said to be the most active. They consider the oil a powerful resolvent and purgative of cold humors, and prescribe it in palsy, asthma, colds, colic, flatulence, rheumatism, dropsy and amenorrhœa; of the seeds, 10 kernels rubbed down with honey are sufficient as a purge. A poultice of the crushed seeds is used to reduce gouty and rheumatic swellings, and inflammation of the breasts of women during lactation. The leaves have similar properties, but in a less degree. The fresh juice is used as an emetic in poisoning by opium and other narcotics; made into a poultice with barley meal it is applied to inflammatory affections of the eye. The root-bark is used as a purgative and alterative in chronic enlargements and skin diseases; it is also applied externally.

In modern medicine Castor oil is much valued as a non-irritant purgative; a drop is sometimes dropped into the eye to allay irritation, and, strange to say, the leaves are applied locally in Europe to promote the secretion of milk, whereas in India the native practice of applying them to stop the secretion of milk is recognised in the Government hospitals under European superintendence. A fluid extract of the leaves has also been recommended in Europe as a lactagogue. As a purgative the oil is best administered in the early morning on an empty stomach, when about one drachm will usually be found sufficient, at other times at least half an ounce will be required. Various fluids have been recommended to conceal the taste of the oil, such as brandy, peppermint water, &c., but the decoction of fresh ginger, as used in India, is, we think, the best vehicle. The above remarks apply to cold drawn oil; the bazar oil extracted

by boiling is more active, and, as it is not always carefully prepared, it may contain the acrid principle of the seed and give rise to disagreeable symptoms. The alleged antirheumatic properties of the plant so insisted upon by Hindu and Mahometan physicians are worthy of being tested by careful clinical observation.

M. H. Meyer (*Pharm. Zeitsch. f. Russland,* xxx., p. 282, 1891), in order to decide the question as to the purgative properties of ricinoleic acid, prepared that substance perfectly pure, also its glyceride, and ricinelaïdic acid. All these preparations were administered to cats, and acted as purgatives. The author concludes that there is no reason to suppose that Castor oil contains any purgative principle other than ricinoleic acid.

Dr. H. Stillmark has discovered in the seeds an albuminoid body which he has named "*Ricin.*" This, however, does not appear to be the purgative principle. Its action, whether given by the mouth or hypodermically, is to produce hæmorrhagic inflammation of the gastro-intestinal tract, affecting primarily the small intestines, and probably obstructing the bile duct, since there is usually extreme fullness of the gall bladder; the inflammation also extends to the vesical mucous membrane. Diarrhœa is by no means constant. The drowsiness and convulsions which occurred in some of his experiments on animals he attributes to possible thrombosis of the cerebral vessels. The lethal dose of ricin for man he calculates to be 6·0 milligrams for a man weighing 60 kilograms, this generally being equal to about ten ordinary seeds, although Christison once had a fatal case, where only three seeds had been swallowed, and, on the other hand, a case is on record in which a person who had eaten 17 seeds, recovered.

Ricin appears to have a peculiar effect upon blood, causing a rapid conglomeration of the red corpuscules, together with the formation of a substance like fibrin. One part of ricin to 60,000 of defibrinated blood is sufficient to cause a separation of the serum, so that the latter is capable of being passed through

a filter. Crotonoleic acid, which exists in croton seeds, was found to be quite distinct from ricin.

The results obtained by Dr. Stillmark find further confirmation in a note in the *Medical Recorder* (July, p. 299), in which it is stated that fifteen children, under six years of age, poisoned by eating castor seeds, suffered from severe vomiting and prostration, but not from catharsis.

Ehrlich (*Deutsche Med. Wochenschr.*, No. 32, p. 976, 1891) reports some interesting experiments with ricin. He found that injected into the veins of animals, it is fatal in doses of three milligrams per kilo of body-weight; taken internally it is a hundred times less active, but still so poisonous that 0·18 gram is a fatal dose for an adult man. He found different animals to be unequally affected by it; guinea pigs were especially susceptible to the poison, but white mice much less so. The symptoms were diarrhœa and prostration: on *post-mortem* examination the appearances in some cases were such as are seen in cholera, but more frequently there was a hæmorrhagic condition of the intestines and often of the subcutaneous cellular tissue.

Ehrlich also succeeded in rendering animals insusceptible to the poison by administering gradually increasing doses internally: at the end of two months of this treatment he found that mice could bear a dose of 5 decigrams of ricin (sufficient to kill an adult man), the fatal dose for an unprotected mouse being 35 milligrams.

The immunity obtained was still more marked in experiments on the conjunctiva; under ordinary circumstances touching the membrane with a 1 per cent. solution of ricin produced intense inflammation, but after several weeks of protective treatment the strongest solution could be freely applied without producing any effect.

The establishment of the immunity appears to commence suddenly on the sixth day, and continues to increase from that time. The author insists upon the similarity between this

sudden immunity and the critical subsidence of fever in certain acute diseases, such as pneumonia, measles, &c., which he considers may also be regarded as indicating the establishment of an immunity in those diseases.

Animals in which an immunity to the ricin poison had been established, were found, six months after the cessation of all treatment, to be incapable of being affected by the poison. Ehrlich has also made similar experiments with *abrin*, the active principle of *Abrus precatorius*, which he reserves for early publication.

Description.—There are many varieties of the plant which have been produced by cultivation; they may be divided into the large red-seeded kinds, and those with grey seeds marked with brown blotches; the latter are preferred for medicinal use.

The roots are tolerably straight, and give off a few rootlets; they are covered by a light-brown bark, nearly smooth, but marked with little transverse warty ridges. The wood is white and soft. The bark has an acrid taste.

The seeds are contained in a tricoccous capsule, one in each cell; they are oblong, from $\frac{1}{4}$ to $\frac{1}{2}$ an inch long and about $\frac{1}{3}$ of an inch broad, the dorsal surface is more arched than the ventral. The apex is somewhat pointed, below it is a tumid caruncula, on the removal of which a dark depressed cicatrix is seen. The testa is grey, marked with brown blotches. The kernel is enclosed in a delicate white membrane, and consists of a copious white albumen, in the axis of which are situated two leafy cotyledons and a short stout radicle.

Microscopic structure.—The epidermis of the seeds is composed of tabular cells, which are here and there coloured in patches which correspond to the spots on the seed. The testa consists of cylindrical cells in close apposition. The kernel is a mass of closely-packed cells with granular contents, but if water is brought in contact with the section, oil globules separate from the albumen. In the latter may be demonstrated the

Aleurone crystals which are found in many seeds. (*Sachs Lehrbuch der Botanik*, p. 554.) The root-bark shows numerous cells filled with a yellow refractive substance which appears to be resinous; in other respects it is not remarkable.

Chemical composition.—The most important constituent of the seeds is the fixed oil called castor oil, of which the peeled kernels afford at most half of their weight.

The authors of the *Pharmacographia* say:—

"The castor oil of commerce has a sp. gr. of about 0·96, usually a pale yellow tint, a viscid consistence, and a very slight yet rather mawkish odour and taste. Exposed to cold, it does not in general entirely solidify until the temperature reaches —18°C. In thin layers it dries up to a varnish-like film.

"Castor oil is distinguished by its power of mixing in all proportions with glacial acetic acid or absolute alcohol. It is even soluble in four parts of spirit of wine (·838) at 15° C., and mixes without turbidity with an equal weight of the same solvent at 25° C. The commercial varieties of the oil, however, differ considerably in these as well as in some other respects.

"The optical properties of the oil demand further investigation, as we have found that some samples deviate the ray of polarized light to the right and others to the left.

"By saponification, castor oil yields several fatty acids, one of which appears to be *Palmitic Acid*. Another acid (peculiar to the oil) is *Ricinoleic Acid*, $C^{18}H^{24}O^{3}$; it is solid below 0° C.; does not solidify in contact with the air by absorption of oxygen, and is not homologous with oleic or linoleic acid, neither of which is found in castor oil. Castor oil is nevertheless thickened, if 6 parts of it are warmed with 1 part of starch and 5 of nitric acid (sp. gr. 1·25), *Ricinelaïdin* being thus formed. From this, *Ricinelaïdic Acid* may easily be obtained in brilliant crystals.

"As to the albuminoid matter of the seeds, Fleury (1865) obtained 3·23 per cent. of nitrogen, which would answer to

about 20 per cent. of such substances. The same chemist further extracted 46·6 per cent. of fixed oil, 2·2 of sugar and mucilage, besides 18 per cent. of cellulose.

"Tuson, in 1864, by exhausting castor oil seeds with boiling water, obtained from them an alkaloid which he named *Ricinine.* He states that it crystallizes in rectangular prisms and tables, which ,when heated, fuse, and, upon cooling, solidify as a crystalline mass; the crystals may even be sublimed. Ricinine dissolves readily in water or alcohol, less freely in ether or benzol. With mercuric chloride, it combines to form tufts of silky crystals, soluble in water or alcohol. Werner (1869), on repeating Tuson's process on 30 lbs. of Italian castor oil seeds, also obtained a crop of crystals, which in appearance and solubility had many of the characters ascribed to ricinine, but differed in the essential point that when incinerated they left a residuum of magnesia. Werner regarded them as the magnesium salt of a new acid. Tuson repudiates the suspicion that ricinine may be identical with Werner's magnesium compound. E. S. Wayne of Cincinnati (1874) found in the leaves of Ricinus a substance apparently identical with Tuson's ricinine; but he considers that it has no claim to be called an alkaloid.

"The testa of castor oil seeds afforded us 10·7 per cent. of ash, one-tenth of which we found to consist of silica. The ash of the kernel previously dried at 100°C., amounts to only 3·5 per cent." (*Op. cit.*, 2nd Ed., p. 569.)

K. Hazura and A. Grüssner (*Moniteur Scient.*, Ap. 1889) infer from their experiments that the liquid acid of castor oil is not a single compound, as has been hitherto supposed, but a mixture of two isomeric acids of the composition $C^{18}H^{34}O^{3}$, one of which, ricinoleic acid, yields on oxidation trioxystearic acid, whilst the other, ricinisoleic acid, yields isotrioxystearic acid. The proportion of these acids is about 1 of the former to 2 of the latter. As no dioxystearic acid has been obtained from the oxidation of the liquid acids of castor oil, it may be concluded that of all the fatty oils hitherto examined, castor oil is the only one which contains no oleine.

The leaves, stem, and root of *R. communis* contain the same active principles as the seeds; a proximate analysis by A. L. Beck (*Amer. Journ. Pharm.*, 1888) gave the following results:—

	Leaves.	Stem.	Root.
Extracted by petroleum spirit	4·582	0·275	0·380
" " ether	2·575	0·316	0·338
" " alcohol	2·490	0·833	......
" " water	12·699	......	......
" " diluted Na OH	1·200	......	......
" " " H Cl	2·193	......	......
Loss by chlorine	5·440	......	......
Residues, cellulose, &c.	43·590	......	......
Ash	11·220	5·466	7·050
Moisture	12·700	6·100	7·083
Loss	1·311	......	......

The poisonous principle present in castor oil seeds has been variously represented as an alkaloid, a glucoside, and an organic acid. But as the result of an exhaustive chemical and pharmacological investigation, recorded in a lengthy treatise (*Arbeit. d. Pharmakol. Inst. Dorpat*, Part III., p. 59), Herr Still-mark has come to the conclusion that it is an albuminoid body, identical with the "B. phytalbumose," separated from the dried juice of *Carica Papaya* by Sidney Martin, and belonging to the class of unformed ferments. This substance, which he has named "ricin," may be prepared by exhausting well-pressed peeled Ricinus seeds, reduced to powder, with a 10 per cent. solution of sodium chloride, saturating the clear percolate at the ordinary temperature with magnesium sulphate and sodium sulphate, and keeping it in a cool place, when, besides large crystals of the two sulphates, a white precipitate, easily separable from these, is formed. This is placed in a dialyser, with frequent changes of water, for six days, after which the residue is removed and dried over sulphuric acid, and can then be reduced to a snow-white powder, which still contains 10 to 20 per cent. of sulphate. This substance is a most powerful poison,

exercising a remarkable power of coagulation, so that the blood coming into contact with a minute quantity that has been absorbed is coagulated, blocks the lumina of the intestinal capillaries, and causes thrombosis and ecchymosis. Even when introduced subcutaneously, the principal action of the poison appears to occur in the intestinal canal, and not at the place of injection. The lethal dose for a man weighing sixty kilograms is estimated as 0·18 gram, and it is stated that this quantity is contained in the press-cake from 3 grams of peeled seeds. In view of this fact, that the residue from the pressing of castor oil contains such large quantities of a tasteless poison exceeding arsenic in toxic power, and at present not to be detected in the body by any known method, Herr Stillmark raises the question, whether it should not be made compulsory upon manufacturers to burn the cake, or render it harmless by a process of boiling that would destroy the ferment. Experiments were also made upon the seeds of nine other species of Ricinus, as well as those of *Croton Tiglium* and *Jatropha Curcas*, and in each case a poisonous albuminoid substance was separated, similar to, if not identical with, ricin, and belonging to the class of ferments. It is pointed out by the author that the coagulating power of ricin explains the external application in some countries of crushed Ricinus seeds as a hæmostatic. (*Pharm. Journ.*, Nov. 2nd, 1889.)

Commerce.—Several varieties of the castor plant are cultivated in India: they may be divided into large-seeded and small-seeded. The seeds of the latter variety only are exported, those of the former being used in India for the preparation of an inferior kind of oil which is used for lubricating machinery, &c.

The exports of seed from 1885-86 to 1888-89 were:—

1885-86	34,000	tons,	valued at	30 lakhs	of Rupees.
1886-87	31,000	„	„	29 „	„
1887-88	36,000	„	„	34 „	„
1888-89	29,000	„	„	31 „	„

Most of the castor seed goes to Italy.

The exports of oil, mostly from Bengal, during the same period, were:—

1885-86...2·2	millions of gallons,	valued at	22	lakhs	of Rupees.
1886-87...2·7	"	"	"	27	"	"
1887-88...2·7	"	"	"	26	"	"
1888-89...2·7	"	"	"	26	"	"

Almost the whole of the oil goes to England.

Ricin has been introduced into commerce by Merck of Darmstadt.

BALIOSPERMUM AXILLARE, *Blume.*

Fig.—*Wight Ic.*, *t.* 1885; *Rheede, Hort. Mal. x.*, *t.* 76.

Hab.—Tropical and Subtropical Himalaya. Deccan Peninsula. The root and seeds.

Vernacular.—Danti (*Hind.*, *Beng.*, *Mar.*, *Guz.*), Kondá-ámádam (*Tel.*), Nága-danti (*Tam.*, *Mal.*).

History, Uses, &c.—This plant, in Sanskrit Danti, Nágádanti or Danta-mulika, with numerous synonyms, such as Upachitra, Makulaka, &c., is much used in Hindu medicine where purgation is indicated, the root being generally prescribed. The seeds (Danti-vija) are also used, and are sometimes sold in the shops as croton seeds. The following formula from Chakradatta will show how the root is prescribed:—

"*Dánti haritaki.*—Take 25 large chebulic myrobalans and enclose them in a piece of cloth, then take of the roots of *Baliospermum axillare* and *Ipomœa Turpethum*, each 200 tolas, water 64 seers, boil them together till the water is reduced to 8 seers. Strain the decoction, take out the chebulic myrobalans and fry them in 32 tolas of sesamum oil. To the strained decoction add 200 tolas of old treacle, then boil till reduced to the proper consistence for a confection. Now add to the mass the following substances: powdered root of *Ipomœa Turpethum* 32 tolas, long pepper and ginger, each 8 tolás, and stir them

well; when cool, add 32 tolas of honey; cinnamon, cardamoms, tejpat leaves, and the flowers of *Mesua ferrea*, each 8 tolas, and prepare a confection. The chebulic myrobalans should be kept embedded in the medicine. Two tolas of the confection and one of the myrobalans are to be taken every morning."

A more simple formula from the Bhavaprakasa is the *Gudáshtaka*. Take of *danti*, *trivrit* (*Ipomœa Turpethum*), and plumbago root, black pepper, ginger and long pepper root, equal parts in fine powder; treacle, equal in weight to all the other ingredients, and mix. Dose about a tola every morning, in flatulence, anasarca, jaundice, &c.

Rheede says of Danti:—Folia, radix atque fructus, tanta purgandi pollent energia, ut solus odor catharsin excitet: folia extrinsice applicata articulari medentur morbo."

Roxburgh remarks:—"The seeds are esteemed by the natives a good purgative; they administer one seed bruised up with water for every evacuation they wish the patient to have. There would appear to be little doubt that the seeds of this plant were the original Dand of the Arabian physicians, but were subsequently superseded by those of *Croton Tiglium*, as has been the case in India.

Description.—Roots nearly straight, seldom branched, about as thick as the finger; bark brown, scabrous; wood yellowish-white, soft and tough. The outer layer of the bark consists of several rows of brick-shaped brown cells, mostly empty, but some of them containing a dark reddish-brown resin; within this the parenchyma is so loaded with conglomerate raphides that its structure is with difficulty seen; it has many cells filled with resin as in the suber, and very numerous yellow liber cells. The wood is loaded with starch.

The seeds weigh about one and a half grains each, and are exactly similar to very small castor seeds.

Commerce.—The seeds are no longer found in the bazars, having been superseded by the imported croton seeds; the root is also difficult to obtain, that sold in the shops as Danti-mul being usually the root of *Ricinus communis*.

TRAGIA INVOLUCRATA, *Linn.*

Fig.—*Burm. Zeyl., t.* 92; *Rheede, Hort. Mal. ii., t.* 39; var. *cannabina, A. Juss. Tent. Euphorb., t.* 15, 49 B.

Hab.—Throughout India. The root.

Vernacular.—Barhanta (*Hind.*), Bichati (*Beng.*), Kanchuri, (*Tam.*), Kánchkuri, Khájkolti (*Mar.*), Dulaghondi (*Tel.*), Haligilu (*Can.*).

History, Uses, &c.—This very variable plant, of which four varieties are described in the *Flora of British India*, is the Vrischikáli of the Rája Nirghanta, where it is said to bear the same name in Marathi and to be called Haligilu in Canarese. It is recommended in bilious fever, and as a diuretic and alterative. Rheede says of it:—"Conducit in febre ossium, ac servit pro pruritu corporis; in decocto data urinam suppressam movet." He also notices its use on the doctrine of signatures as a remedy for the sting of the Ray fish.

Ainslie (ii., 61 and 389) says:—"The root, which is sometimes called 'Coorundootievayr,' has in its dried state but little taste or smell, though in its more succulent condition it has a rather pleasant odour; it is considered as diaphoretic and alterative, and is prescribed in decoction, together with other articles of like virtues, to correct the habit in cases of *mayghúm* (cachexia), and in old venereal complaints, attended with anomalous symptoms; an infusion of it is also given as a drink in ardent fever, in the quantity of half a teacupful twice daily."

In the Concan the roots of these plants are used to aid the extraction of Guinea-worm, a paste made from them being applied to the part. A paste of the roots with Tulsi juice is also used as a cure for itchy eruption of the skin. In Tanjore, the root is boiled with cow's milk and taken at bedtime for dry cough.

Description.—Shrubby, climbing, 4 to 5 feet high; leaves petioled, 3-divided, serrate, hairy, 2 to 4 inches long; stipules half lanceolate; racemes erect, many-flowered; male flowers numerous on the upper part of the raceme, very small,

yellow, each with three bracts; female flowers beneath the male, two on each raceme, with the calyx leaflets pinnatifid. The plant stings like the nettle. For a description of its varieties, the reader is referred to the *Flora of British India.*

EXCÆCARIA AGALLOCHA, *Linn.*

Fig.—*Wight Ic., t.* 1865 *B; Rheede, Hort. Mal. v., t.* 45. Blinding tree, Tiger's milk tree (*Eng.*), Arbre aveuglant (*Fr.*).

Hab.—Tidal forests of India. The juice and cork.

Vernacular.—Gaoura, Uguru, Gangwa, Geria (*Beng.*), Chilla (*Tel.*), Haro (*Can.*), Gevá, Phungali, Hura (*Mar.*), Tillai-cheddi (*Tam.*).

History, Uses, &c.—This tree was named *Agallocha* by the old botanists, from a supposition that a kind of Aloe-wood was yielded by it; but Loureiro, speaking of *E. cochin-chinensis*, remarks, "nec agallochum, quamvis spurium, in illa inveneri." The wood is white, soft, and spongy, and has no aromatic properties. All parts of the tree abound in an acrid milky juice, which causes intense pain if it gets into the eyes; this juice is said to be used in Australia and New Guinea to cure ulcers, leprosy, &c. If collected it hardens into a kind of caoutchouc, a grain or two of which is used by the boatmen on the Western Coast of India as a purgative. Ainslie (ii., 438) states that a decoction of the leaves is occasionally given by Hindu doctors in epilepsy, in the quantity of a quarter of a teacupful twice daily. This decoction is also used as an application to ulcers.

Smith (*Econ. Dict.*, 5) states that in Fiji the plant is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with the green leaves; he is then placed in a small room and bound hand and foot, and a small fire is made of pieces of the wood, from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke, enduring the most agonising torture and often fainting. When thoroughly smoked, he is removed, and the slime is scraped

from the body; he is then scarified and left to await the result, which, if the patient survives, is said to be a cure.

From the lower part of the trunk and roots of this tree a soft, light, reddish suber is obtained, which is sold by the itinerant medicine men of Western India, under the name of *Tejbul,* as an aphrodisiacal tonic. It occurs in irregular-shaped pieces about half an inch thick, and often as large as the palm of the hand, from which the epidermis has been removed by scraping and trimming. The structure is that of coarse cork, the cells being about six times the size of ordinary cork cells. This substance has a glistening appearance, and is always kept saturated with water, so that on breaking it, it appears to be full of juice. It is inodorous and tasteless.

On some parts of the Coast it is said to be used for making floats for fishing nets.

Description.—A small evergreen tree or shrub, growing along with Rhizophora and Avicennia, and sometimes called the "milky mangrove." Leaves ovate, between fleshy and coriaceous, 2 to 4 inches, entire or sinuate crenate, pale brown when dry, base acute or rounded; nerves many, very faint, subhorizontal; petiole ½ to 1 inch. Flowers fragrant, male spikes numerous, 1 to 2 inches; female racemes few, ½ to 1 inch. Bracts of male spike with one flower and several minute bractioles. Filaments much lengthened after flowering. Styles free nearly to the base. Seeds subglobose, smooth. The variations in the size of the fruit and seeds are remarkable. (*Fl. Br. Ind.*)

Plants of minor importance belonging to this order, which are used medicinally, are:—

Macaranga Roxburghii, *Wight Ic., t.* 817, a small tree of the Deccan Peninsula, with peltate, cordate leaves, small green flowers, and fruit the size of a pea. The young shoots and fruit are covered with a clammy, reddish secretion having an odour like turpentine. The country people use the following in *Jarandi* (*Angl.,* Liver):—One part of the young shoots, with 3 parts of the young shoots of Khoróti (*Ficus asperrima*), are

sprinkled with hot water and the juice extracted; in this is rubbed down 2 parts each of the barks of both trees. The preparation may be administered twice a day in doses of ⅛ of a seer. The Marathi name is Chándvar. The bark contains 18·4 per cent. of tannic acid, giving a blue-black precipitate with ferric chloride, and the air-dried bark leaves 11 per cent. of mineral matter on incineration.

Chrozophora plicata, *A. Juss., Burm. Ind., t.* 62, *f.* 1, is a common weed on cultivated ground, and in the bottoms of dried up tanks in many parts of tropical India in the cold season. It is reputed to have alterative properties, and is mentioned by Ainslie as a plant which Dr. F. Hamilton had brought to him in Behar, as one of those which was supposed to have virtues in leprous affections; the dry plant is made into a decoction to which is added a little mustard. (*Mat. Ind.*, ii., 398.)

Sebastiania Chamælea, *Müll-Arg., the Cadi-avànacu* of Rheede (ii., 34), and the Bhui-erandi of the Concan, is a small plant, with linear, finely serrated leaves and small spinous cocci, the juice of which in wine is used as an astringent; a *ghrita* of the plant is considered to be tonic, and is applied to the head in vertigo.

URTICACEÆ.

GIRONNIERA RETICULATA, *Thwaites.*

Fig.—*Bedd. Fl. Sylv., t.* 313. Syn., *Celtis reticulata.*

Hab.—Sikkim, Himalaya, Assam, Burma, Pegu, Deccan Peninsula, Ceylon. The wood.

Vernacular.—Koditáni (*Tam.*), Kho-manig (*Nilgiri*), Nárakiya-ood (*Ind. Bazars*).

History, Uses, &c.—This wood does not appear to be mentioned by Indian medical writers, nor can we find any record of its collection in India for medicinal use, the bazars being supplied from Ceylon, where it has probably been in use from a remote period.

Thunberg says :— "The tree is called by the Dutch *Strunthout*, and by the Cingalese *Urenne*, on account of its disgusting odour, which resides especially in the thick stem and the larger branches. The smell of it so perfectly resembles that of human ordure, that one cannot perceive the smallest difference between them. When the tree is rasped, and the raspings are sprinkled with water, the stench is quite intolerable. It is nevertheless taken internally by the Cingalese as an efficacious remedy. When scraped fine and mixed with lemon juice, it is taken internally, as a purifier of the blood in itch and other cutaneous eruptions, the body being at the same time anointed with it externally." (*Thunberg's Travels*, iv., 234.)

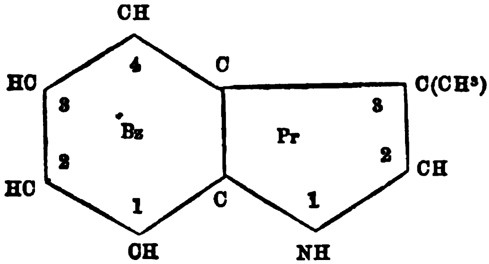
Thunberg obtained leaves and young plants of the tree, but no blossoms; the plants were all killed by cold in the English Channel.

The Portuguese call the wood *Pao de merda* or *Pao sujo.* In India it is burnt as a fumigatory to drive away evil spirits; the bazar name signifies "hellish incense." In Ceylon, according to Mr. J. Alexander, it is hung up near dwelling-houses as a charm to keep away evil spirits. As sold in the bazars it is a light-brown wood in irregular-shaped pieces, having a penetrating odour, exactly similar to that of fresh human ordure.

Chemical composition.—The wood has been examined by Prof. W. R. Dunstan. By distillation with water a minute quantity of a solid crystalline substance was obtained. It possessed a fæcal odour, and after purification melted at 93·5°C. Its physical and chemical properties were not those of α-naphthylamine. It afforded a crystalline picrate, by the analysis of which the substance was shown to possess the composition of methyl-indole (C^9H^9N), and by its physical and chemical properties it was proved to be identical with the Pr. 3 methyl-indole, or skatole, which Brieger isolated in 1877 from human fæces, and Salkowski soon afterwards obtained from among the putrefaction products of animal proteid. Nenchi has observed the formation of the same substance when potash is fused with albumen, and it has also been prepared synthetically. Skatole

from *G. reticulata* corresponds in all its properties with synthetical skatole from propylidene phenyl-hydrazide. The occurrence of skatole in a plant has not hitherto been observed; it has appeared to be a characteristic product of the bacterial resolution of animal proteid. (*Pharm. Journ.*, June 15th, 1889.)

The nomenclature followed is that which has been proposed by Emil Fischer. The benzene nucleus of indole being designated by *Bz*, and the pyrrole nucleus by the contraction *Pr*, the nitrogen of the pyrrole nucleus is numbered 1, as well as the corresponding carbon atom of the benzene nucleus; thus the formula of skatole is—



Holoptelea integrifolia, *Planch., Wight Ic., t.* 1968; *Roxb. Cor. Pl., t.* 78; *Bedd. Fl. Sylv., t.* 310, a tree extending from the Lower Himalayas to Travancore, has a mucilaginous bark, which is boiled and the juice squeezed out and applied to rheumatic swellings; the exhausted bark is then powdered and applied over the parts covered by the sticky juice. The vernacular names of the tree are Papri (*Hind.*), Aya (*Tam.*), Navili (*Tel.*), Vavala (*Mar.*), Rasbija (*Can.*)

CANNABIS SATIVA, *Linn.*

Fig.—*Bentl. and Trim., t.* 231; *Reichb. Ic. Fl. Germ., t.* 655; *Rheede, Hort. Mal. x., tt.* 60, 61. Hemp (*Eng.*), Chanvre (*Fr.*).

Hab.—N.-W. Himalaya. Cultivated in India. The leaves, female flowering tops, resinous exudation, and seeds.

Vernacular.—The leaves—Bhang, Sabji (*Hind.*, *Beng.*, *Mar.*), Ganja-ilai, Bangi-ilai (*Tam.*), Ganja-aku, Bangi-aku (*Tel.*), Kancháva-ela (*Mal.*), Bangi (*Can.*), Bháng (*Guz.*). Flowering tops—Gánja (*Hind.*, *Beng.*, *Guz.*), Ganja (*Tam.*, *Tel.*, *Mar.*), Kancha (*Mal.*), Bangi (*Can.*). The resin—Charas (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Ganja-pál (*Tam.*), Ganja-rasam (*Tel.*), Kanchava-pála (*Mal.*), Bangi-gondu (*Can.*). The seeds—Gánje-ke-bij (*Hind.*), Ganja-virai (*Tam.*), Ganja-vittulu(*Tel.*), Kanchava-vitta (*Mal.*), Bangi-bija (*Can.*), Ganja-bij (*Beng.*), Bhanga-cha-bi (*Mar.*), Bháng-nu-bi (*Guz.*).

History, Uses, &c.—The hemp plant, in Sanskrit Bhanga and Indrasana, "Indra's hemp," has been known in the East as a fibre plant from prehistoric times. It is mentioned along with the Vedic plant Janjida, which has magic and medicinal properties, and which is described in the Athavaveda (ix., 34, 35) as a protector, and is supplicated to protect all animals and properties. The gods are said to have three times created this herb (oshadhi). Indra has given it a thousand eyes, and conferred on it the property of driving away all diseases and kiillng all monsters; it is praised as the best of remedies, and is worn as a precious talisman; along with hemp it prevents wandering (vishkandha), fever and the evil eye. De Gubernatis says that in Sicily the peasant women still believe in hemp as an infallible means of attaching their sweethearts. On Good Friday they take a thread of hemp and twenty-five needlefuls of coloured silk, and at midnight weave them together, repeating the following lines:—

Chistu è cánnavu di Christu
Servi pi attaccari a chistu.

"This is the hemp of Christ; it serves to attach this man." They then enter the Church with the thread in their hands, and at the moment of the consecration of the host, they make three knots in it, adding at the same time some hairs of the man they are in love with, and invoke all the demons to attract him to his sweetheart. (*Cf.* Mattia 'di Martino, *Usi e credenze popolari Siciliane*, Woto, 1874.) Burns in "Halloween" notices a

closely-allied superstition. The intoxicating properties which the plant possesses in its Eastern home appear not to have been discovered until a more recent date, but in the fifth chapter of Menu, Brahmins are prohibited from using it, and in the sacred books of the Parsis the use of *Bana* for the purpose of procuring abortion is forbidden. In Hindu mythology the hemp plant is said to have sprung from the *amrita* produced whilst the gods were churning the ocean with Mount Mandara. It is called in Sanskrit Vijaya, "giving success," and the favourite drink of Indra is said to be prepared from it. On festive occasions, in most parts of India, large quantities are consumed by almost all classes of Hindus. The Brahmins sell Sherbet* prepared with *Bhang* at the temples, and religious mendicants collect together and smoke *Ganja*. Shops for the sale of preparations of hemp are to be found in every town, and are much resorted to by the idle and vicious. Hemp is also used medicinally; in the *Rája Nirghanta* its synonyms are Urjaya and Jaya, names which mean promoter of success, Chápala "the cause of a reeling gait," Ananda "the laughter moving," Harshini "the exciter of sexual desire"; among other synonyms are Kashmiri "coming from Kashmir," Matúláni "the maternal uncle's wife," Mohini "fascinating," &c. Its effects on man are described as excitant, heating, astringent; it destroys phlegm, expels flatulence, induces costiveness, sharpens the memory, excites appetite, &c. Susruta recommends the use of Bhang to people suffering from catarrh. In the *Rájavalabha*, a recent work in use in Bengal, we are informed that the gods through compassion on the human race sent hemp, so that mankind by using it might attain delight, lose fear, and have sexual desires.

The seductive influences of hemp have led to the most extravagant praise of the drug in the popular languages of India, but in truth it is one of the curses of the country; if its use is persisted in, it leads to indigestion, wasting of the body, cough, melancholy, impotence and dropsy. After a time its votary

* *Sabzi* or *Sabji*, an infusion of *Bhang* with black pepper, anise and sugar. In Bengal milk, and cucumber and melon seeds are added.

becomes an outcaste from society, and his career terminates in crime, insanity, or idiotcy.

> *Ganja pie gur-gyan ghate, aur ghate tan andar ka,*
> *Khokat, khokat dam nikse, mukh dekho jaisa bandar ka.*

> Who ganja smoke do knowledge lack, the heart burns constantly,
> The breath with coughing goes, the face as monkey's pale you see.
> *Fallon.*

According to tradition, the use of hemp as an intoxicant was first made known in Persia by Birarslan, an Indian pilgrim, in the reign of Khusru the first (A.D. 531—579), but, as we have already stated, its injurious properties appear to have been known long before that date.

There can be no doubt that the use of hemp as an intoxicant was encouraged by the Ismailians in the 8th century, as its effects tended to assist their followers in realising the tenets of the sect:—

> بنگی زدیم سر انا الحق شد آشکار
> مارا باین گیاهٔ ضعیف این گمان نبود

> We've quaffed the emerald cup, the mystery we know,
> Who'd dream so weak a plant such mighty power could show!

Hasan Sabáh, their celebrated chief, in the 11th century notoriously made use of it to urge them on to the commission of deeds of daring and violence so that they became known as the Hashsháshin or "Assassins." Hasan studied the tenets of his sect in retirement at Nishapur, doubtless at the monastery noticed by O'Shaughnessy (*Bengal Dispensatory*), in the following terms:— "Haidar lived in rigid privation on a mountain between Nishapur and Rama, where he established a monastery; after having lived ten years in this retreat, he one day returned from a stroll in the neighbourhood with an air of joy and gaiety; on being questioned, he stated that, struck by the appearance of a plant, he had gathered and eaten its leaves. He then led his companions to the spot, who all ate and were similarly excited. A tincture of the hemp leaf in wine or spirit seems to have been the favourite formula in which Sheikh Haidar indulged himself. An Arab poet sings of Haidar's emerald cup, an evident

allusion to the rich green colour of the tincture. The Sheik survived the discovery ten years, and subsisted chiefly on this herb, and on his death his disciples at his desire planted it in an arbour round his tomb. From this saintly sepulchre the knowledge of the effects of hemp is stated to have spread into Khorasán. In Chaldea it was unknown until 728 A. H., the kings of Ormus and Bahrein then introduced it into Chaldea, Syria, Egypt and Turkey."

Taki-ed-din Ahmad, commonly known as Makrizi, who wrote a number of treatises upon Egypt in the 14th century, mentions the lease of the monopoly for the sale of Hashish in that country, and its abolition in (1286) by the Sultan.

Haji Zein in the Ikhtiárát (1368), after noticing the two kinds of Kinnab mentioned by the Greeks, states that Indian hemp is known as *Bang* or *Sabz* in Shiraz; after describing its properties, he says that in cases of poisoning by it vomiting should be induced by the administration of butter and hot water to empty the stomach, and that afterwards acid drinks should be administered.

The Greeks were acquainted with hemp more than 2000 years ago; Herodotus (iv., 74, 75) mentions it as being cultivated by the Scythians, who used its fibre for making their garments, and the seeds to medicate vapour baths. Dioscorides mentions two kinds of κανναβις, the wild and the cultivated; the former is the *Althæa cannabina* of Linneus, and the latter *Cannabis sativa;* he states that the seeds, if eaten too freely, destroy the virile powers, and that the juice is used to relieve earache. Galen and the early Arabian physicians, such as Ibn Sina and Rázi, follow Dioscorides in his opinion of the properties of hemp, and do not notice its having any intoxicating properties, and unless the *Gelotophyllis* of Pliny (24, 102) was Indian hemp, there is no evidence to show that the ancients were acquainted with them. Pliny says:—"The Gelotophyllis (laughing leaf) is a plant found in Bactriana, and on the banks of the Borysthenes. Taken internally with myrrh and wine, all sorts of visionary forms present themselves, and excite the

most immoderate laughter, which can only be put an end to by taking kernels of the pine nut, with pepper and honey, in palm wine." The earliest Western medical writer who distinctly mentions the intoxicating properties of hemp is Ibn Baitar, a native of Africa, who died in Damascus in 1248. All the later Mahometan physicians describe the two kinds of Kinnab mentioned by the ancients, whom they quote, and a third kind called *Hindi* or Indian. The name Cannabis is derived from the Persian Kanab. which is connate to the Sanskrit S'ana, the Russian Kanopla, the Irish Canaib, the Iceland Hanp, the Saxon Hænep, and the old German Hanaf.

The author of the *Makhzan-el-Adwiya* gives Udifarúnas* as the Yunáni name, and Kanabira as the Syrian, and also mentions a number of cant terms which are applied to it, such as Wark-el-khyál, Hashish, Hashishat-el-fukará, Arsh-numá, Chatr-i-akhzar, &c. *Charas* is described, and the practice of smoking it. The Bengal-grown hemp is said to be less intoxicating than that grown in more Northern climates. Hempseed is called in Persian Shahdánah, "royal seeds." The leaves are made into Sherbet and conserves for intoxicating purposes. The properties of hemp are described as cold and dry in the third degree, that is, stimulant and sedative, imparting at first a gentle reviving heat, and then a refrigerant effect, the drug at first exhilarates, improves the complexion, excites the imagination, increases the appetite, and acts as an aphrodisiac; afterwards its sedative effects are observed—if its use is persisted in, it leads to indigestion, wasting of the body, melancholy, impotence and dropsy.

Mirza Abdul Razzak considers hemp to be a powerful exciter of the flow of bile, and relates cases of its efficacy in restoring appetite, of its utility as an external application as a poultice with milk in relieving hæmorrhoids, and internally in gonorrhœa, to the extent of a quarter drachm of bhang.

Charas is only mentioned in comparatively recent medical works. The word is said to be derived from the Sanskrit चर्मे

* Some such word may have been manufactured by the Syrian monks in the Middle Ages, possibly from ἐῦ and διαφέρω as an equivalent to the Sanskrit 'Vijaya.'

a skin, but it occurs in Persian with the primary signification of a piece of leather or cloth, the four corners of which are tied up so as to form a wallet, such as beggars carry; in Hindi it signifies a leather bag for holding water, &c. The Charas collected in Central Asia is stored in leathern bags by the cultivators. Among European writers in the East, Rheede and Rumphius figure and describe the Indian plant; the latter states that the kind of mental excitement it produces depends upon the temperament of the consumer. He quotes a passage from Galen, lib. I. (*de aliment. facult.*), in which it is asserted that in that great writer's time it was customary to give hempseed to the guests at banquets, as a promoter of hilarity and enjoyment (the seeds are still roasted and eaten in the East). Rumphius adds, that the Mahometans in his neighbourhood frequently sought for the male plant from his garden, to be given to persons afflicted with virulent gonorrhœa or with asthma, and the affection which is popularly called "stitches in the side." He tells us, moreover, that the powdered leaves check diarrhœa, are stomachic, cure the malady named *Pitao*, and moderate excessive secretion of bile. He mentions the use of hemp smoke as an enema in strangulated hernia, and of the leaves as an antidote to poisoning by orpiment.

In the *Bulletin de Pharmacie* (1810, p. 400), we find it briefly described by M. Rouyer, apothecary to Napoleon, and member of the Egyptian Scientific Commission, in a paper on the popular remedies of Egypt. With the leaves and tops, he tells us, collected before ripening, the Egyptians prepare a conserve, which serves as the base of the *berch*, the *diasmouk*, and the *bernaouy*. Hemp leaves reduced to powder and incorporated with honey, or stirred with water, constitute the *berch* of the poor classes.

Ainslie notices *Májún*, a confection made with hemp leaves to be used as a sweetmeat, the composition of which varies in different parts of the East, and to which are often added other intoxicating drugs. O'Shaughnessy in the *Bengal Dispensatory* 1842 gives a detailed account of its preparation in Calcutta.

The medicinal properties of Cannabis have now been investigated by many European physicians in India. O'Shaughnessy tried it with more or less success in various diseases, especially in tetanus, hydrophobia, rheumatism, the convulsions of children and cholera. Subsequent experience has confirmed the value of the drug as a remedy in tetanus and cholera. In the former disease we have obtained most satisfactory results, large doses are required, and the patient must be kept under the influence of the drug for some days.

In cholera its action may be compared with that of opium; it is most likely to be successful when resorted to early in the disease. People suffering from painful chronic diseases, such as rheumatism, are completely relieved of their pains by hemp, but as the effects of the drug go off, the pains return; some of O'Shaughnessy's patients became cataleptic whilst under its influence. Christison, speaking of Indian Hemp, says:—"I have long been convinced, and new experience confirms the conviction, that for energy, certainty, and convenience, it is the next anodyne, hypnotic and antispasmodic, to opium and its derivatives, and often equal to it."

Among the "*special opinions*" collected by Dr. Watt for the *Dict. of the Econ. Prod. of India*, we observe that Dr. S. J. Rennie recommends the tincture in doses of from 15 to 20 minims three times a day in acute dysentery, and states that he, as well as other medical officers, obtained excellent results with it. Dr. J. E. T. Aitchison states that the oil of the seeds, known as *Kandir yak* in Turkistan, is used in Kashmir as a liniment for rheumatic pains. Others notice it as having valuable narcotic, diuretic and cholagogue properties. (*Op. cit.*, vol. ii., p. 124.)

A. Aaronson states in the *British Journal of Dental Science*, that the tincture as a local anæsthetic is perfectly satisfactory. He has extracted with its aid as many as twenty-two teeth and stumps at one sitting. His plan is to dilute the tincture some three or five times, according to the probable duration of the operation. The diluted tincture is then applied on cotton

wool to cavities, if such exist, and also about the gums of the affected teeth. The beaks of the extracting forceps are also, after being warmed, dipped in the tincture. In cold weather it is best to dilute the tincture with warm water. His patients acknowledge the immunity from pain they enjoyed during the operations, and all expressed surprise and pleasure at the simplicity of the performance.

Tannate of cannabin has recently been recommended as a hypnotic. Cannabis appears capable, directly or indirectly, of causing uterine contraction, as in many cases of uterine hæmorrhage; and it is also said to provoke this act during labour with as much energy as ergot, but with less persistant action.

A recent correspondence in the *Lancet*, anent the variation in action and occasional toxic effects of this drug, has brought from Dr. J. Russell Reynolds an important contribution respecting its clinical value.

In explaining the occasional toxic effects of this drug, Dr. Reynolds says two things must be remembered: first, that, by its nature and the forms of its administration, cannabis indica is subject to great variations in strength. Extracts and tinctures cannot be made uniform, because the hemp grown at different seasons and in different places varies in the amount of the active therapeutic principle. It should always be obtained from the same source, and the minimum dose should be given at first, and gradually and cautiously increased. The second important fact to keep in view is, that individuals differ widely in their relations to various medicines and articles of diet—perhaps to none more than to substances of vegetable origin, such as tea, coffee, ipecacuanha, digitalis, nux vomica, and the like. In addition to the purity of the drug, the possibility of idiosyncrasy must be borne in mind as calling for caution in giving Indian hemp. By gradually increasing the dose and habituating the organism to its use, the use of cannabis indica may be pushed to 3 or 4 grains of the extract at a dose with positive advantage. But in Dr. Reynolds' experience 1 grain would

bring about toxic effects in the majority of healthy adults; and $\frac{1}{4}$ of a grain has done the same, but never $\frac{1}{5}$, which is the proper amount with which to begin the use of the drug among grown persons, $\frac{1}{10}$ of a grain being the proper initial dose for children. The best preparation for administration is the tincture—1 grain to 20 or 10 minims—dropped on sugar or bread. The minimum dose should be given, as before stated, repeated every four or six hours and gradually increased every third or fourth day, until either relief is obtained or the drug is proved useless. With such precautions, Dr. Reynolds states he has never met with toxic effects, and rarely failed to ascertain in a short space of time the value or uselessness of the drug.

Its most important results are to be found in the mental sphere; as, for instance, in Senile Insomnia, with wandering. An elderly person (perhaps with brain softening), is fidgety at night, goes to bed, gets up, thinks he has some appointment to keep, that he must dress and go out. Day, with its stimuli and real occupations, finds him quite rational again. Nothing can compare in utility to a moderate dose of Indian hemp at bedtime—$\frac{1}{4}$ to $\frac{1}{3}$ of a grain of the extract. In alcoholic subjects it is uncertain and rarely useful. In Melancholia it is sometimes serviceable in converting depression into exaltation; but unless the case has merged into senile degeneration, Dr. Reynolds does not now employ cannabis indica. It is worse than useless in any form of mania. In the occasional night restlessness of general paretics and of sufferers from the "temper disease" of Marshall Hall, whether children or adults, it has proved eminently useful.

In painful affections, such as Neuralgia, Neuritis, and Migraine, Dr. Reynolds considers hemp by far the most useful of drugs, even when the disease is of years' duration. In neuritis the remedy is useful only in conjunction with other treatment, and is a most valuable adjunct to mercury, iodine, or other drugs, as it is in neuralgia when given with arsenic, quinine, or iron, if either is required. Many victims of diabo-

lical migraine have for years kept their sufferings in abeyance by taking hemp at the threatening or onset of the attack. In sciatica, myodynia, gastrodynia, enteralgia, tinnitus aurium, muscæ volitantes, and every kind of so-called hysterical pain, cannabis indica is without value. On the other hand, it relieves the lightning pains of Ataxia, and also the multiform miseries of the gouty, such as tingling, formication, numbness, and other paræsthesiæ.

In clonic spasm, whether epileptoid or choreic, hemp is of great service. In the Eclampsia of children or adults, from worms, teething (the first, second, or third dentition), it gives relief by itself in many cases. Many cases of so-called Epilepsy in adults—epileptoid convulsions, due often to gross organic nerve-centre lesions—are greatly helped by cannabis indica, when they are not affected by the bromides or other drugs. Take, for instance, violent convulsions in an overfed man, who is attacked during sleep a few hours after a hearty supper, the attacks recurring two or three times an hour for a day or two, in spite of "clearing the primæ viæ," or using bromine or some other classic drug. These attacks may be stopped at once with a full dose of hemp. In brain tumours or other maladies in the course of which epileptoid seizures occur, followed by coma, the coma being followed by delirium,—first quiet, then violent—the delirium time after time passing into convulsions, and the whole gamut being repeated, Indian hemp will at once cut short such abnormal activities, even when all other treatment has failed. In genuine epilepsy it is of no avail. In cases where it has seemed to do good, the author doubts the correctness of the diagnosis, and suspects organic lesion or eccentric irritation. In tonic spasms, such as torticollis and writers' cramp, in general chorea, in paralysis agitans, in trismus, tetanus, and the jerky movements of spinal sclerosis, cannabis indica has proved absolutely useless. At the same time, it is most valuable in the Nocturnal Cramps of gouty or old persons, in some cases of Spasmodic Asthma, and in simple Spasmodic Dysmenorrhœa. Thus it will be perceived that for the relief of suffering, quite apart from a curative effect, hemp must ever

be held in high esteem, and ranked with the poppy and with mandragora. (*Medical Annual*, 1891.)

Physiological action.—Like some other narcotics, Indian hemp, when given by the stomach to carnivorous animals, produces its characteristic effects, but graminivorous animals and fish exhibit only vacillating movements and a dull aspect. Upon man its action varies with the individual's temperament and tendencies. Some it inspires with pugnacity, others it inclines to dreamy contemplation, to motiveless merriment, or to maudlin sensibility; some it makes unnaturally active and restless, and plunges others in a drowsy stupor; but more than any other agent, not even excepting belladonna, it perverts the natural perception of objects and their normal condition and relations. Time, distance, and sound are especially apt to form the subjects of the hallucinations caused by this drug. As in dreams, the events of days or weeks may be compressed into an actual period of a few minutes, objects near at hand may seem to form a limitless perspective, and whispered tones may have the reverberation of thunder. These and an infinite variety of fantastic pictures are evoked by smoking the drug, as it is generally employed in Asia, associated with opium. During its influence the physical condition of the experimenter exhibits changes in acceleration of the pulse, warmth of skin, restless muscular movements, more or less insensibility to touch and pain, and sometimes impaired power of locomotion, the limbs feeling as if weighted with lead. In one reported case a diffused vesicular eruption was attributed to this medicine. (*Hyde.*) It does not increase, but, on the contrary, impairs, the venereal propensity and power. The habitual use of cannabis in excessive doses causes the face to become bloated, the eyes injected, and the limbs weak and tremulous; the mind grows imbecile, and ultimately death by marasmus is apt to occur. Acute poisoning by large doses is marked by various and dissimilar symptoms in different cases. In some there is loss of consciousness, with collapse or stupor, insensible pupils, a pale, clammy, and insensible skin, extreme debility, and a small, feeble pulse. In others a cataleptic condition, spasms, or convulsions occur, and in all there is

marked anæsthesia. The last-named effect led to the use of cannabis by the Chinese in certain surgical operations. (*Stillé and Maisch.*)

Collection.—The flowering tops of the female plant are collected, and, after having been allowed to wither in the open air for about 48 hours, are arranged on a mat so as to form a circle, and are trodden upon by a number of men, linked together by resting their arms across each other's shoulders, who walk round and round; the object being to compress the resinous flower tops into a compact mass. This process is repeated several times after shifting and re-arranging the *Gánja*. In Bengal a round kind of *Gánja* is prepared by rolling the flowering tops under the feet, and afterwards between the palms of the hands. During the manufacture of *Gánja* a quantity of powder separates, which is known as *Chúr* or *Rora;* it is collected, mixed with an extract of the plant, and made into round balls about the size of a musket ball, which are used for smoking like *Charas*. A similar preparation is made from the dust of the leaves; it is popularly known as *Charas;* several varieties of it are found in the bazars. True *Charas* is collected in Central Asia by shaking, rubbing, or beating the resinous exudation from the flowering plant; it separates as a greyish powder, which, after being packed in bags, gradually consolidates into an oily resinous mass. The genuine article is rarely to be met with in commerce, that sold in the bazars being largely adulterated by the middlemen in the Punjab with the leaves and dust of *Bhang*. *Bhang* is made by collecting the leaves and drying them. All of these drugs are obtained from the female plant, which the natives consider to be the male, because it bears the seed; all male plants are carefully extirpated by the *hemp doctor*, a person whose business it is to prune the plants so as to produce the maximum amount of flowering heads.

Description.—*Bhang* consists of the dried leaves, which are of a deep green colour and usually broken, so as to form a coarse powder; the odour is peculiar. The leaves have long

petioles and are digitate, with linear-lanceolate, sharply serrated leaflets, tapering to a long smooth point.

Gánja is the name given to the flowering tops of the female plant. The flowers form erect clustered spikes, often 6 to 8 inches long; in the drug, the spikes are compressed, flat or round, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour.

Pure *Charas* is a greenish-brown, moist, resinous mass, having the peculiar odour of the plant, and consists of resin mixed with the hairs and fragments of the leaf. Bazar *Charas* varies much in quality, some specimens being only very partially soluble in spirit, friable, and of an earthy appearance. Sixty grains of the finest Yarkand *Charas* which we examined left, after exhaustion with spirit, only 13 grains of residue, chiefly hairs of the plant.

Chemical composition.—The most interesting constituents of hemp, from a medical point of view, are the resin and the volatile oil. The former was first obtained in a state of comparative purity by T. and H. Smith in 1846. (*Pharm. Journ.*, vol. vi., p. 171.) It is a brown, amorphous solid, burning with a bright white flame, and leaving no ash. It has a very potent action when taken internally, two-thirds of a grain acting as a powerful narcotic, and one grain producing complete intoxication.

When water is repeatedly distilled from considerable quantities of hemp, fresh lots of the latter being used for each operation, a volatile oil lighter than water is obtained, together with ammonia. This oil, according to the observations of Personne (1857) (*Journ. de Pharm.*, vol. 39, p. 48), is amber-coloured, and has an oppressive hemp-like smell. It sometimes deposits an abundance of small crystals. With due precautions it may be separated into two bodies, the one of which named by Personne *Cannabene,* is liquid and colourless, with the formula $C^{18}H^{20}$, the other, which is called *Hydride of Cannabene,* is a solid, separating from alcohol in platy crystals, to which Personne assigns the formula $C^{18}H^{22}$. He asserts that cannabene has indubitably a physiological action, and even claims it as the

sole active principle of hemp. Its vapour he states to produce, when breathed, a singular sensation of shuddering, a desire of locomotion, followed by prostration and sometimes by syncope. Bohling, in 1840, observed similar effects from the oil, which he obtained from the fresh herb just after flowering, to the extent of 0·3 per cent.

As to the resin of Indian hemp, Bolas and Francis, in treating it with nitric acid, converted it into *Oxycannabin*, $C^{20}H^{20}N^{2}O^{7}$. This interesting substance may, they say, be obtained in large prisms from a solution in methylic alcohol. It melts at 176° C., and then evaporates without decomposition; it is neutral. (*Pharmacographia.*)

Preobraschensky (*Pharm. Zeitsch. f. Russland*, 1876, p. 705) made a chemical examination of a quantity of *haschisch*, which he brought with him from China, and was enabled, according to his own statement, to separate from it a volatile alkaloid, which he held to be identical with nicotine, and which he believed to be the active principle of cannabis. This, in view of the distinctive and very different action of cannabis, was somewhat remarkable. It is highly probable, as has been suggested by Dragendorff and Marquiss (*Pharm. Zeitung*, 1877), that the *haschisch* used by Preobraschensky was mixed with tobacco, which it often is in Eastern countries.

Louis Siebold and Bradbury reported to the British Pharmaceutical Conference (1881) that, after an elaborate investigation, they had arrived at the conclusion of Dragendorff and Marquiss, and that in the course of their investigation they made the interesting discovery that pure cannabis does actually contain a volatile alkaloid, which does not, however, possess the characters of nicotine. They separated it in very small quantity, obtaining not more than 2 grains from 10 lbs. of Indian hemp. They give it the name of *Cannabinine.* They record no observations as to its physiological action; and they, therefore, leave it doubtful as to whether this volatile alkaloid is the narcotic principle of cannabis. (*Pharm. Journ.*, xii., p. 326.)

Dr. Hay (*Pharm. Journ.*, xiii., p. 998) made a chemical examination of the drug, the results, so far, of which lead him to believe that *Cannabis indica* contains several alkaloids. He says:—"In a future communication I hope to be able to give an exact description of the distinctive characters and toxic action of each. In the meantime, I shall content myself with the description of one which I have obtained in a considerable degree of purity, and one which, rather remarkably, possesses an action similar to that of strychnia. It is evidently, therefore, quite a secondary alkaloid of the cannabis, and reminds one of the thebaine of opium. This alkaloid was obtained from a watery infusion of powdered *Cannabis indica* by treating it with a solution of subacetate of lead, and filtering. To the filtrate was added ammonia, and the precipitate removed by filtration. The filtrate, acidulated with sulphuric acid, was now treated with a solution of phospho-wolframic acid in order to precipitate the alkaloids present. The precipitate, which was fairly abundant, was, after the fluid had been removed by filtration and washing with dilute sulphuric acid and pressing, mixed with barium hydrate and water, which formed an insoluble wolframate and set free the alkaloids. The filtrate was next deprived of its excess of barium by means of a stream of carbonic acid gas and again filtered. The filtrate was at a gentle heat evaporated almost to dryness and acidulated with sulphuric acid, and treated with absolute alcohol. The sulphate of the alkaloids thus formed was partially soluble in alcohol, partly not. It was from the soluble part that the alkaloid in question was procured. The sulphate was converted into a chloride by treatment with barium hydrate, afterwards with carbonic acid to remove excess of barium, and, finally, with hydrochloric acid to neutralization. The chloride was evaporated and treated with absolute alcohol, in which it in part dissolved. From the solution, by addition of excess of carbonate of soda and frequent shaking with ether, an alkaloid was obtained in the form of colourless needle-like crystals.

"The alkaloid was easily soluble in water, soluble also in alcohol, and more slowly soluble in ether and chloroform. It

caused tetanus in frogs in exactly the same manner as strychnia, increasing the excitability of the reflex centres of the spinal cord. It did not give a violet colour with sulphuric acid and bichromate of potash. It was, therefore, although similar in action to strychnia, not chemically identical with it. A solution of it in water was precipitated by the various alkaloidal precipitants, platinic chloride, iodide of potassium and mercury, phosphotungstate of soda, phosphomolybdic acid, phospho-wolframic acid, &c. Although I obtained the alkaloid from 1 kilo. of cannabis, yet the quantity of it was so small that it was insufficient for an elementary analysis.

"To this alkaloid I propose to give the name of *tetano-cannabine*, as indicative of its action."

The Tannate of *Cannabin* of Merck (*Pharm. Jour.*, xiii., p. 1052), a glucoside contained in Indian hemp, which he has combined with tannin, is a yellowish-brown powder, with a taste of tannin, and a rather agreeable odour; it is insoluble in water and ether, and only slightly soluble in alcohol; in alkaline solutions it dissolves readily. This substance is said to be free from any admixture of the volatile alkaloid of *Cannabis indica*, not to produce intoxication, and to be useful as a hypnotic; it is said not to derange the digestive and secretory organs like opium, and to be especially valuable in irritable states of the nervous system, but Dr. H. C. Wood has found it to be inert physiologically. Warden and Waddell of Calcutta, although operating on a large quantity of Indian hemp of ascertained activity, were unable to find any evidence of the existence of such a principle as Dr. Hay describes. They further remark that:— "As many of those addicted to the Hashish form of intemperance obtain the intoxicating effects by smoking the plant in a pipe, it is to be expected that destructive distillation of the freshly prepared resin might yield up the active principle. This process was therefore resorted to. By the destructive distillation of freshly prepared alcoholic extract of the plant to which an excess of caustic potash solution had been added, an amber-coloured oil was obtained, which, by exposure to the air or the action of alkalies,

rapidly became of a dark reddish-brown colour. This oil had a mildly empyreumatic odour, which was distinctly tobacco-like. Its taste was warm, aromatic, and somewhat terebinthinate. The oil contained phenol, ammonia, and several other of the usual products of destructive distillation.

"The nicotine-like principle contained in this oil appeared to be an alkaloid. It formed salts which evolved a strong nicotine-like odour when acted on by alkalies. But physiologically it was found to be inert, and therefore was evidently not identical with nicotine.

"The oil as a whole was also found to be devoid of any narcotic or irritant qualities. About $\frac{1}{8}$ of an ounce was introduced into the stomach of a cat without producing any sensible effect. These results do not coincide with those of Personne, who asserted that the active principle of the plant resided in the volatile oil. It is just possible that the active principle was decomposed by the high temperature necessary for destructive distillation." (*Ind. Med. Gaz.*, Dec. 1884.)

Kennedy (*Pharm. Record*, vi., p. 304) made a search for nicotine in Indian hemp without success, but obtained indications of the presence of another alkaloid.

E. Jahns (*Archiv. d. Pharm.*, 1887) reported that he had separated from Indian hemp a base which he has identified as *choline*, and points out that this result corresponds fairly with the statement of previous workers, except in respect to the crystallizability of Dr. Hay's alkaloid and solubility in ether. The quantity of choline obtained by the author from different samples varied considerably, but amounted at the most to only $\frac{1}{10}$ per cent.

H. F. Smith (*Amer. Journ. Pharm.*, Aug. 1891), by two entirely different processes, obtained an alkaloid from Indian hemp, which separated from ethereal solutions in the form of a yellowish-green, transparent varnish-like substance. It had a strong, peculiar odour, resembling that of coniine; was soluble in ether, chloroform, alcohol, and acidulated water, but only slightly so in water; was alkaline to test paper and capable of

neutralizing acids. When dissolved in very dilute H^2SO^4 (1 gtt. in 5 cc.), it gave a clear yellow solution and the following reactions:—

With Mayer's reagent, an abundant white precipitate.
„ $KI+I+H^2O$, an abundant brown precipitate.
„ Phosphomolybdate of soda, an abundant white precipitate.
„ Solution of picric acid, an abundant yellow precipitate.
„ „ $K^2C^2O^7$, a yellowish-brown precipitate.
„ „ NH^4OH, a yellowish-green precipitate.
„ „ NaOH, a yellowish-green precipitate.
„ „ KOH, a yellowish-green precipitate.
„ „ KI, a yellowish precipitate.
„ „ tannic acid, a yellowish-brown precipitate.

Supposing this alkaloid of Indian hemp to be highly poisonous, it is present in so small a quantity as to be of little if any importance therapeutically.

Toxicology.—Lyon says—" In India, Cannabis appears to be seldom, if ever, used for homicidal purposes. Fatal, accidental or suicidal cases have, however, been reported. Cases have also been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. Thus Chevers mentions a case which occurred at Ahmednagar, in which a woman, having first drugged with *majun*, a child aged seven, afterwards murdered him for the sake of his ornaments. (*Med. Jurisp.*, p. 225.) Harvey reports a case in which *charas* appears to have been used by a road-poisoner at Amritsar, in order to facilitate theft. (*Beng. Med. Leg. Rep.*, 1870-72, p. 268.) A case is also reported by Dr. Cullen of Hoshangabad, in which *majun* was given to a woman and her daughter, "not with the intention of causing death, but to effect a criminal purpose." In these two females, the symptoms present exactly resembled those of dhatura-poisoning, and it would appear that dhatura is sometimes used as an ingredient of *majun*. (*Lyon, Med. Jurisp.*, p. 260.) Ganja is frequently used as a poison in Southern India, chiefly administered with criminal intent. In

a case of dacoity investigated near Madura in 1886, it was found that *ganja* had been given in food served up to some travellers. It is resorted to by the relatives of converts to Christianity in Travancore, to prevent them changing their religion or to punish them for doing so.

Dr. Hové, a Polish *savant*, who was sent out to Bombay by the British Government in 1787-89, speaking of Cannabis, says (p. 141): "I arrived at Mithampoor and waited on the Rajah, who ordered provisions for my people and guards. He also ordered to each person a basinful of a beverage which is called by the inhabitants *Beng*. This is nothing else but a decoction of seeds, and bruised leaves and stalks of the Cannabis, which has, however, such powerful quality, that even the steam where it was served overpowered me in a few minutes, so that I was under the necessity of leaving the room." We have no doubt that Cannabis is much more frequently used in India for drugging people than is generally known.

Commerce.—The sea-borne trade in preparations of hemp is insignificant; a small quantity of *ganja* goes to Europe for medicinal use. The imports by trans-frontier routes do not exceed 2½ lakhs of rupees yearly, and the exports 20 to 25 thousand rupees. As regards internal trade, the total annual revenue transactions (transfers, &c.) amount to about 15 lakhs of rupees. The wholesale cost of *ganja* duty-free is about 4½ annas per lb., and of *bhang* Rs. 8 per cwt. The revenue realised by the Indian Government by the duty on hemp is about 30 lakhs of rupees yearly. For full particulars of the Hemp trade in India, see *Dict. Econ. Prod. of India*, ii., p. 113.

FICUS RELIGIOSA, *Linn.*

Fig.—*King, Fic.* 55, *t.* 67 A, 84u; *Wight Ic., t.* 1967; *Rheede, Hort. Mal. i., t.* 27.

Hab.—India. The root-bark.

FICUS BENGALENSIS, *Linn.*

Fig.—*King, Fic.* 18, *t.* 31, 81c; *Wight Ic., t.* 1989; *Rheede, Hort. Mal. i., t.* 28.

Hab.—India. The root-bark.

FICUS TJAKELA, *Burm.*

Fig.—*King, Fic.* 57, *t.* 70, 84x; *Rheede, Hort. Mal. iii., t.* 64.
Hab.—India. The root-bark.

FICUS GLOMERATA, *Roxb.*

Fig.—*Roxb. Cor. Pl. ii., t.* 123; *Wight Ic., t.* 667.

Hab.—India. The root-bark, fruit, juice, and galls.

Vernacular.—*F. religiosa*, Pipal, Pipar (*Hind., Mar., Guz.*), Aswat, Asud (*Beng.*), Arasa (*Tam.*), Rai, Raiga (*Tel.*), Rangi, Basri (*Can.*). *F. bengalensis*, Bar, Bargat (*Hind., Beng., Guz.*), Vara, Vari (*Mar.*), Ala (*Tam.*), Mari, Peddi-mari (*Tel.*), Aladamara (*Can.*). *F. Tjakela*, Ram-anjir, Pákhar (*Hind., Beng.*), Bassári, Pakri, Lendva (*Mar.*), Jovi (*Tam.*), Jevi (*Tel.*), Kari, Bassári (*Can.*) *F. glomerata*, Gúlar, Umar (*Hind.*), Jagnodumar (*Beng.*), Atti (*Tam.*), Moydi, Atti (*Tel.*), Kulla-kith (*Can.*), Umbara (*Mar.*), Umbro (*Guz.*).

History, Uses, &c.—In the *Káthaka Upanishad* an eternal and cosmogonic Aśvattha or Pippal tree is described; this tree is said to have its roots above and branches below (úrdhvamúlo' vákśakha esho' śvatthah sanátanah); it bears the names of 'seed,' 'brahman,' 'amrita'; the worlds rest upon it; beneath it there is nothing. The wood of the Aśvattha when rubbed against that of the Sami (*Acacia Suma*) engenders fire, which is symbolic of reproduction, the former representing the male and the latter the female energy. At the marriage ceremony of the Hindus, both of these plants are necessary. To this mythic tree which represented the macrocosm, wonderful medicinal properties are ascribed in the Atharvaveda; the medicine chest of the Vedic physician, and the cup to contain

the Soma, are to be made of it; its branches are the Vedas. In the *Válakhilya*, a collection of apocryphal hymns in the *Rig-veda*, the marriage of the actual tree with Tulasi is enjoined; it is worshipped on Saturdays in the month of Sravan and on Somvatis or "lunar days." Women perform Pradakshina, "walking round it from left to right," to secure the survival of their husbands and good luck generally, as Savitri, the wife of Satyavan, is said to have recovered her deceased husband by its worship. The thread ceremony and marriage of the tree with the Durva (*Cynodon Dactylon*) is also performed by women. Sacrificial spoons are still made from its wood. *F. religiosa* is the *Budhidru*, or tree of wisdom, of the Jains and Buddhists, who relate that at the birth of the Buddha an enormous Aśvattha sprung from the centre of the universe, an offshoot, no doubt, of the Vedic and cosmogonic tree. In the *Rája Nirghantu* it bears the synonyms of Yájnika "sacrificial," Srimana "fortunate," Vipra "wise," Sevya "worthy of worship," &c. Its root-bark, together with that of the three other species of *Ficus* placed at the head of this article, and the root-bark of the Neem, form the *Panchavalkala* or "five barks," and a decoction of them (panchavalkala kasháya) is much used as a gargle in salivation, as a wash for ulcers, and as an astringent injection in leucorrhœa. The powdered root-bark of the Aśvattha, rubbed with honey, is applied to apthæ and unhealthy ulcers to promote granulation.

F. bengalensis, the Vata or Nyagrodha, has been sometimes confounded with the Aśvattha; both trees bear the synonyms Bahupada "many-footed," and Śikhandin "crested," but the Vata is specially described as Skandaja "born of the trunk," Ava-roha-śáyin "sending down branches," Skanda-ruha "growing from its own trunk," Páda-rohana, &c. In Indian mythology an enormous Vata tree is supposed to grow upon mount Supárśva, to the south of the celestial mount Meru, and to cover eleven yojanas; in the Vishun Purana we find a similar account of the Pippala growing on mount Vipula and covering eleven hundred yojanas. Devaki, when pregnant with Krishna, is said to have taken refuge under a Vata tree from Kansa, who had destroyed her first six children. The tree was a

special favorite of the Buddha, and Arrian speaks of the Indian sages as sitting under it. There is one famous tree mentioned in the *Ramayana*, the *Uttara Rama-charitra*, the *Kurma-purana*, and elsewhere, which still grows on an island in the Nerbudda; it is said to have been planted by the sage Kabira some two thousand years ago, and is popularly known as the *Kabir Bar*. Owing to the peculiar growth of these trees, there is no reason why they should not last for an indefinite period.

The figs of the Udumbara (*F. glomerata*) are considered to be astringent, stomachic and carminative, and are given in menorrhagia and hæmoptysis, in doses of one tola of the dried fruit with sugar and honey. The fresh juice of the ripe fruit is used as a vehicle (*Vern.* अनुपान) for metallic preparations. The juice of the root is used as a tonic, is applied to glandular swellings,* and is given in doses of four tolas with cumin and sugar in gonorrhœa. The small blister-like galls, which are common on the leaves, are soaked in milk and mixed with honey as a remedy for pitting in small-pox. This tree bears the synonyms of Yajniya "sacrificial," Pavitraka "purifier," &c., and is much used in Hindu ceremonial. According to the *Grihya Sutra*, a married woman in the fourth month of pregnancy should be rubbed with the fruit to fortify the germ.

F. Tjakela, in Sanskrit Parkati or Parkatin, Supárśva and Plaksha, is the waved-leaved fig-tree, a sacred tree, but of minor importance. It is the Tsjakala of Rheede.

Mahometan and European writers do not add much to our knowledge of the medicinal properties of these trees. Ainslie, speaking of *F. glomerata*, says:—" From the root of the tree, which in Tamil is called *attierayr*, there exudes, on its being cut, a fluid, which is caught in earthen pots, and which the Vytians consider as a Cúlpám (*Tam.*), that is, a powerful tonic, when drank for several days together. This Cúlpám is termed *attie-vayr tannic.*" (*Mat. Ind.*, ii., p. 30.)

* It is interesting to not that the juice of the *F. Sycomorus*, Linn., the *συκομόρος* of Dioscorides, and the جميز (Jumíz) of the Arabs, was used by the Greeks, and is still used in Egypt for a similar purpose, and that both trees have much the same habit. (*Dios.*, i, 148, and *Prosper Alpinus*, p. 20). The Indian Mahometans use *F. glomerata* as a substitute for *F. Sycomorus*.

Ainslie also states that the seeds of *F. religiosa* are supposed to possess cooling and alterative qualities, and quotes the following passage from Bartolomeo's *Voyage to the East Indies*: "Pulverised, and taken in water for fourteen days together, the fruit removes asthma, and promotes fruitfulness in women." The tree is the *Areálu* of Rheede, and the *Arbor conciliorum* of Rumphius. (*Mat. Ind.*, ii., p. 25.)

The white glutinous juice of *F. bengalensis* is applied as a remedy for toothache, and to the soles of the feet when cracked and inflamed. The leaves, after they have turned yellow, are given in the Concan with roasted rice in decoction as a diaphoretic; dose, three leaves.

Description.—*F. religiosa*, a tree.—Leaves long-petioled, ovate, cordate, narrow acuminate, acumen one-third the length of the leaf, entire, or repandly undulated towards the apex; fruit-receptacles axillary, paired, sessile, depressed, size of a small cherry, appearing in the hot season and ripening in the rainy season, purple when ripe.

F. bengalensis, a tree.—Branches spreading very much; lower ones rooting; leaves alternate, ovate, bluntly acuminated, with parallel nerves, paler underneath, entire, downy when young, afterwards smooth; fruit-receptacles axillary, paired, sessile, as large as a middle-sized cherry, appearing and ripening in the hot season, red or yellow when ripe.

F. Tjakela, a tree.—Leaves rather long-petioled, membranaceous, oblong, or sublanceolate-oblong, moderately and acutely acuminated, obtuse or rounded, or subcordate at the base, quite entire, or very slightly repand; fruit small, sessile, twin, globose, smooth, when ripe white.

F. glomerata, a tree.—Trunk crooked, thick, bark of a rusty-greenish colour, rough; leaves alternate, petioled, oblong or broad lanceolate, tapering equally to each end, entire, very slightly 3-nerved, smooth on both sides; racemes compound or panicled, issuing immediately from the trunk or large branches; fruit pedicelled, nearly as large as the common fig, clothed with soft down, purple when ripe. For a full

botanical account of the Genus, the reader is referred to Dr. G King's "*Species of Ficus.*"

Chemical composition.—The bark of *F. religiosa* contains 3·8 per cent. of tannin, that of *F. racemosa* 14·1 per cent., and that of *F. bengalensis* 10·9 per cent. The air-dried bark of *F. racemosa* yields 12·2 per cent. of ash, that of *F. bengalensis* 8·05 per cent., and that of *F. religiosa* 11·7 per cent. The tannin gives a green precipitate with ferric salts. There is nothing else of interest in these barks, except caoutchouc and wax.

FICUS CARICA, *Linn.*

Fig.—*Woodv., t.* 244; *Steph. & Ch., t.* 154; *Reich. Ic. Fl. Germ. xii., t.* 659. The Fig (*Eng.*), Figue (*Fr.*).

Hab.—Persia. Cultivated in India. The fruit.

Vernacular.—Anjir (*Hind., Guz., Mar., Beng.*), Shimai-atti, Tén-atti (*Tam.*), Shima-atti, Téne-atti (*Tel.*), Shime-atti (*Can.*).

History, Uses, &c.—The Fig holds much the same place in the mythology of the West as the *Pipal* and *Bar* do in Indian mythology. It has been regarded from prehistoric times as an anthropogonic tree and valued for its nutritious fruit. It is frequently mentioned in the sacred books of the Hebrews and by early Greek and Latin writers. Hippocrates notices it in several places as having aperient, emollient and nutritious properties, and as being useful as an article of diet in phlegmatic affections. Figs were used in lustration by the Greeks. The celebrated *Ficus ruminalis* of Rome, appears, like the Indian Ásvattha (*F. religiosa*), to have been regarded as a cosmogonic tree. Pliny gives the following description of it:—"Colitur ficus arbor in foro ipso ac comitio Romæ nata, sacra fulguribus ibi conditis. Magisque ob memoriam ejus quæ nutrix fuit Romuli ac Remi conditoris appellata, quoniam sub ea inventa est lupa infantibus præbens *rumen* (ita enim vocabant *mammam*), miraculo ex acre juxta dicato, tamquam in comitium sponte transisset." In the worship of Dionysus, the fig played an important part; the phallus was made of its wood and the

fruit was a necessary offering to the god. In the early Christian mythology this phallic tree became accursed, the tree of Judas, &c., and was supposed to be haunted by evil spirits, and the early Italian missionaries in India gave the name of *albero del diavolo* to the Indian fig-tree. For a full account of the myths and superstitions connected with the fig, we must refer the reader to De Gubernatis. (*Myth. des Plant.*, ii., 137—143.) The fig appears to have been known to the Arabs and Persians from prehistoric times. Aitchison (*Botany of the Afghan Delimitation Commission, Trans. Lin. Soc.*) gives an interesting account of the wild fig-tree of Eastern Persia, and Abu Hanifeh, author of the *Book of Plants*, describes the fig as wild in the Saráh, and commonly eaten by the people in its fresh state, and also dried and stored. In the chapter of the Koran entitled "The fig" (التين), it is mentioned along with the olive. God, say the commentators, swears by these two fruits, because of their great uses and virtues, for the fig is wholesome and easy of digestion, and medicinally good to carry off phlegm, and gravel in the kidneys or bladder, and to remove obstructions of the liver and spleen, and it cures piles and the gout, &c.

The cultivation of this tree in India was introduced by the Mahometans, and is now carried on by both Mahometans and Hindus in many parts of the country; caprification is not practised, and all the fruit which we have seen is much inferior to that grown in Europe. Two varieties, the purple and the green, are cultivated in the Bombay Presidency, where the area under fig cultivation is about 300 acres; the Hindus are fond of the fruit, which they consider to be cooling and nutrient; they also use the unripe fruit as a vegetable. The fruit of *F. Roxburghii* as grown at Alipore, near Calcutta, attains a large size, and when ripe is of a bright red; it is not unpalatable.

Dried figs were brought to India from Arabia and Persia, long before the tree was cultivated in the country, by the early Arab traders to the Western Coast, and overland from Persia; they are of a small kind, pressed flat and strung upon a string made of camels' hair; when well washed and stewed in syrup

they are not unpalatable. We have frequently used them for the preparation of confection of senna with satisfactory results.

Description.—A fig consists of a thick, fleshy, hollow receptacle of a pear-shaped form, on the inner face of which grow a multitude of minute fruits. This receptacle, which is provided with an orifice at the top, is at first green, tough and leathery, exuding when pricked a milky juice; on maturity it becomes soft and juicy, and the milky juice is replaced by a saccharine fluid. The orifice is surrounded, and almost closed by a number of scales, near which, and within the fig, the male flowers are situated, but they are often wanting, or are not fully developed. The female flowers stand further within the receptacle, in the body of which they are closely packed; they are stalked, have a five-leafed perianth and a bipartite stigma. The ovary, which is generally one-celled, becomes when, ripe; a minute, dry, hard nut, popularly regarded as a seed. (*Pharmacographia.*)

Chemical composition.—Exclusive of the achenes, which, together with the cellular tissue, Bley (1831) found to constitute about 15 per cent. of the weight of figs, he obtained 16 per cent. of water, 62·5 per cent. of sugar (glucose), the remainder being gum, fat, and saline constituents. The mean of five analyses of dried figs reported by König affords the the following percentage results:—

Water	31·20
Albuminoids	4·01
Sugar	49·79
Ash	2·86

The anhydrous figs contained ·92 per cent. of nitrogen and 2·26 per cent. of sugar.

A. Hansen in 1886 found that the latex of *Ficus Carica* contained principles capable of effecting four fermentative changes; they peptonise albuminoids in the presence of either alkalies or acids, act on starch like diastase, and coagulate the casein of milk. The products of digestion are the same as with pepsin, although the two ferments are not identical. In 1890,

U. Mussi separated from fig sap a digestive ferment which he named "cradina," from *krade* (κράδη), the name given by the Greeks to the part of the fig with which they associated the digestive property. It contains nitrogen, and differs from pepsin in maintaining its digestive power in an alkaline liquor, and from papain or papayotin in being insoluble in water, not precipitated from solution by alcohol or lead acetate, and in its activity not being diminished in the presence of hydrochloric acid.

The following species of Ficus are also considered to have medicinal properties:—

Ficus Rumphii, *Bl. King Fic.* 54, *t.* 673, 84t; *Wight Ic.*, *t.* 640,—Pákar (*Hind.*), Gai-asvat (*Beng.*), Pair, Ashta (*Mar.*), a native of the hill slopes of North-Western and Central India, is a tree having much the appearance of the Pipal; leaves on very long petioles (6 to 8 in.), broad-cordate, with a short and sudden acumination, rather membranaceous with waved margins, finely reticulated beneath, perfectly smooth; fruit paired, sessile, round, smooth, black, of the size and appearance of a black cherry. The juice is used in the Concan to kill worms, and is given internally with turmeric, pepper and ghí, in pills, the size of a pea, for the relief of asthma; it causes vomiting. The juice is also burned in a closed vessel with the flowers of *Mudar*, and four gunjás' weight of the ashes mixed with honey is given for the same purpose.

Ficus retusa, *Linn. King Fic.* 50, *t.* 61, 62, 84p; *Wight Ic.*, *t.* 642,—Kámrup (*Hind.*, *Beng.*), Yerra-juvi (*Tel.*), Pilaka (*Can.*), Jili (*Tam.*), Nandruk (*Mar.*), a native of the base of the Eastern Himalaya and of the Deccan Peninsula, is used medicinally in rheumatism, the leaves and bark being pounded and applied as a poultice. In the Concan the following prescription is in use for flatulent colic:—Take of Nandruk leaf-juice, Tulsi leaf-juice, and ghí, equal parts; boil until all the water has evaporated; do this again 21 times with fresh quantities of the juice of the two plants; the residuum may then be applied to the belly, and fomentation with a hot brick be practised.

Rheede notices a similar use of the plant. (*Hort. Mal.*, iii., t. 55.) The juice of the bark has a reputation in liver disease; dose, 1 tola in milk.

Ficus asperrima, *Roxb. Wight Ic.*, *t.* 633,—Kál-umar (*Hind.*), Kara-karbuda (*Tel.*), Khargas (*Can.*), Kharvat, Kharoti (*Mar.*), a native of Central India and the Deccan Peninsula, remarkable for the roughness of its leaves, which are used as sand paper by the natives, and have been given the name of *Folhas da raspa* by the Portuguese, is a small tree with ovate, alternate, very rough leaves of a pale green colour, at the apex of the petiole and in the axils of the leaf-veins there are small shining green glands as in *F. hispida,* except that the glands are more completely in the axils, and appear closed, whereas in the latter plant they have a distinct stoma. The leaves owe their roughness to the presence of calcareous hairs. Both the juice of the plant and the bark are well-known remedies for glandular enlargements of the abdomen, such as liver and spleen. Rheede says that the root taken in the morning with palm vinegar "viscerum ardorem compescit." The bark is brown, scabrous and brittle, and has a bitter and astringent taste.

Chemical composition.—The bark contains a crystalline principle soluble in alcohol, which is precipitated by alkaloidal reagents, and is not coloured by the stronger acids. It also contains an organic acid precipitated by gelatine, and darkened in colour by ferric chloride. The ash of the air-dried bark afforded 18·4 per cent. of white calcareous ash.

Ficus hispida, *Linn. Wight Ic., tt.* 638, 641, the *F. dæmonum* of Kœnig, is the Kakodumbara or Kakodumbarika, "crows' fig," of Sanskrit writers, and is stated in *Madanpal's Nighanta* to have the same properties as *F. glomerata.* It is the Kát-gular of Hindustan, the Kako-dumar of Bengal, the Bokhera or Dhed-umbar of Bombay, and the Pe-attis of Madras. Rheede says that the fruit boiled in goat's milk is used in hepatic obstruction; it has been brought to notice by Mr. M. Sheriff on account of its emetic properties. The shrub has

opposite, cuneate, oblong leaves, which are scabrous above and downy beneath. The fruit is like a small fig and very downy; it usually grows from the stem near or beneath the ground; an interesting description of it by Dr. G. King forms one of the series of *Scientific Memoirs by Medical Officers of the Army of India*, published at the Government Printing Press, Calcutta. In Bombay and the Concan the powdered fruit heated with a little water is made into a *lep*, or poultice, which is applied to buboes, which it either disperses or brings rapidly to maturity. The fruit is also given to milch-cattle to dry up their milk.

The emetic properties of the plant are due to the presence of saponin.

Chemical composition.—The bark contained 2·1 per cent. of tannin, and some wax and caoutchouc-like substance. No alkaloid was discovered, but a glucosidal principle, having the properties of saponin, was separated from a decoction by barium hydrate. The air-dried bark yielded 13·6 per cent. of mineral matter on incineration.

Ficus gibbosa, *Bl. King Fic.* 4, *t.* 2; *Wight Ic.*, *t.* 650, is a native of the bases of the hill ranges throughout India. It is a climbing shrub, and often a tree with a stem as thick as a man's arm; leaves alternate, very shortly petioled, somewhat ovate, suddenly acuminated, very unequally sided, cuneate toward the base; lateral nerves 3 to 4 on each side, prominent, spreading, uniting in arches, pale green, rough, length 3 to 4 inches, sometimes a little toothed on the margin; fruit small. The *Flora of British India* describes four varieties of this plant. In Western India the root-bark is considered to be stomachic and gently aperient. The Marathi name is Dántira, the Telugu names Konda-juvi and Tella-barinka.

Chemical composition.—The bark contains 4·3 per cent. of tannin; besides some colouring matter, a small quantity of an alkaloidal principle was separated from the tincture, having no very characteristic reactions with the strong acids. The ash of the air-dried bark was 15 per cent.

ANTIARIS TOXICARIA, *Lesch.*

Fig.—*Bot. Mag. i., t.* 17; *Wight Ic., t.* 1958; *Bedd. Fl. Sylv., t.* 307. The Upas tree (*Eng.*), Antiar vénéneux (*Fr.*).

Hab.—The Deccan Peninsula, Ceylon. The nuts.

Vernacular.—Chándul, Chándakuda, Sápsúndí (*Mar.*), Nettavil-maram (*Tam.*), Jajhugri (*Can.*), Araya-angeli (*Mal.*).

History, Uses, &c.—"Most exaggerated statements respecting this plant were circulated by a Dutch Surgeon about the close of the last century. The tree was described as growing in a desert tract, with no other plant near it for the distance of 10 or 12 miles. Criminals condemned to die were offered the chance of life if they would go to the Upas tree and collect some of the poison. They were furnished with proper directions, and armed with due precaution, but not more than two out of every twenty ever returned. The Dutch Surgeon Foersch states that he had derived his information from some of those who had been lucky enough to escape, albeit the ground around was strewn with the bones of their predecessors; and such was the virulence of the poison, that " there are no fish in the waters, nor has any rat, mouse, or any other vermin been seen there; and when any birds fly so near this tree that the effluvia reaches them, they fall a sacrifice to the effects of the poison. Out of a population of 1,600 persons, who were compelled, on account of civil dissensions, to reside within 12 or 14 miles of the tree, not more than 300 remained in less than two months. Foersch states that he conversed with some of the survivors, and proceeds to give an account of some experiments that he witnessed with the gum of this tree, these experiments consisting principally in the execution of several women, by direction of the Emperor! Now, as specimens of this tree are cultivated in botanic gardens, it cannot have such virulent properties as it was stated to have; moreover, it is now known to grow in woods with other trees, and birds and lizards have been observed on its branches. It occasionally grows in certain low valleys in Java, rendered unwholesome by an escape of carbonic acid gas from crevices in

the ground, and which is given off in such abundance as to be fatal to animals that approach too closely. These pestiferous valleys are connected with the numerous volcanoes in the island. The craters of some of these emit, according to Reinwardt, sulphureous vapours in such abundance as to cause the death of great numbers of tigers, birds and insects; while the rivers and lakes are in some cases so charged with sulphuric acid, that no fish can live in them." (*Treasury of Botany.*)

In Travancore *A. toxicaria* is known as the *sacking tree*, and is not regarded by the natives as poisonous; the same is the case in Coorg, where sacks and even garments are sometimes made from the inner bark. In the Concan and in Canara the bitter seeds are used as a febrifuge, and as a remedy in dysentery, one-third to one-half of a seed being given three times a day.

The use in the Malayan region of a vegetable poison to tip the bamboo arrows which are discharged from a blowpipe, is too well known to need description. To this the name *Upas* is given in Java, and *Ipoh* by the Malays elsewhere. Both words have the same meaning, and, according to Blume, signify poison. There is no doubt that this poison is the produce of *A. toxicaria.* In 1878, Regnault experimented with a poison used by the savages of Tonkin to poison their arrows, and in a communication to the *Société de biologie* he showed that this substance was a powerful heart poison. Baillon identified the leaves from which the poison was prepared as those of *A. toxicaria.* In 1881, Sir Cecil Smith, then Colonial Secretary to the Straits Settlements, forwarded to Kew a bottle of Ipoh poison as well as foliage specimens of the tree from which it was obtained. These were collected by Sir Hugh Low, then British Resident in Perak, at the Plus River. The poison was subjected to a careful examination by Dr. Sidney Ringer, who reported that it was perfectly inert. The plant seemed identical with that collected by Griffith, and both were identified at Kew with the Javanese *A. toxicaria.* In 1888, Chauvet (*Thèse Bordeaux*) examined the arrow poison of Indo-China, and came to the same conclusions concerning its poisonous properties as were arrived at by Regnault in 1878. In 1889, the Straits

Government sent to Kew further specimens of *Ipoh* poison, which were again examined by Dr. Ringer with entirely negative results. Botanists were not, however, unprepared for this result. The Dutch botanist, Blume, in his fine work '*Rumphia*,' has given an elaborate account of the Javanese *Upas* and of the tree which yields it (pp. 46—59, tt. 22, 23), but he points out that Rumphius, our earliest authority on Malayan botany, distinguished two kinds of Upas trees, which he termed *Arbor toxicaria femina* and *mas* respectively. Rumphius's *femina* was destitute of any poisonous qualities, and Blume has described it as a distinct species under the name of *A. innoxia* (*Rumphia*, pp. 171—173, t. 54). He received specimens from the island of Timor, where Spanoghe* found that the sap was destitute of any poisonous effect on animals; he also gives Celebes as a locality for the innocuous plant. Other botanists have not, however, found themselves able to attach much weight to the distinctive characters pointed out by Blume, and there can be no doubt that what weighed principally in his mind was the remarkable difference in the properties of the two forms. Species are, however, made by botanists on structural (morphological) differences and not on physiological. In the same species of *Cinchona* it is now known that there are the widest differences in the amount and even nature of the alkaloids which can be extracted from the bark. An equally striking, and even better known instance of differences in properties, unaccompanied by any difference in external characters, is afforded by two well-known British umbelliferous plants, *Œnanthe crocata* and *Cicuta virosa*, which Sir R. Christison found to be innocuous when grown near Edinburgh.

Brandis in his '*Forest Flora*' has identified with *A. innoxia* the *A. saccidora* of South-west India. According to Beddome, this is "the largest tree of the vergreen forests of the Western Ghauts, and the hills betweem taem and the Coast." Sacks are made of the thick woolly fibrous inner bark. The method is thus described

* Spanoghe's account of the innocuous Upas of Timor is printed, together with that of Leschenault on the virulent kind, in Hooker's *Companion to the Botanical Magazine*, Vol. I., pp. 308—317.

by Graham:—"A branch is cut corresponding to the length and diameter of the sack wanted, soaked a little, and then beaten with clubs till the fibre separates from the wood. This done, the sack formed of the bark is turned inside out, and pulled down, until the wood is sawed off, with the exception of a small piece left to form the bottom of the sack, which is carefully left untouched."

Brandis remarks (*l. c.*, p. 427) :—"Another species of the same genus (*Myah seik*, Burm.) is found in the dense evergreen forests of the Thoungyeen Valley. In Tenasserim the juice is used by the Karens to poison arrows, but the poison does not seem equal in its effects to that of the famous Upas tree of the Indian Archipelago." Mason refers the Pegu Upas to *A. ovalifolia*, a very large timber tree scattered in the forests from Mergui to Toungoo. The milky juice is intensely bitter, and when swallowed produces sore-throat. Arrows that have been smeared with it and hung exposed to the air, lose their power to produce death, and there is said to be a difference in the virulence of the poison at different times of the year. Nothing more seems to be known of the tree which yields the Karen arrow poison, but it is very probably referable to *A. toxicaria*, and Gamble (*Manual of Indian Timbers*, p. 332) refers the Burmese name *Myah seik* to that species. (*Archives de Physiologie*, 3,1891; *Kew Bulletin*, 50,1891.)

In 1891, MM. E. Boinet and E. Hedon examined the arrow poison used by the Muongs of Tonkin. They found the quantity of the poison on each bamboo arrow to be about half a gram of a brownish substance soluble in water. Three drops of a solution of 0·50 gram of the poison in 10 grams of water placed upon a frog's heart arrested the pulsations in seven minutes, and a subcutaneous injection of one centigram of the poison proved fatal to a guinea pig. From twenty experiments, it was found that one centigram per kilo body-weight was rapidly fatal to the animals experimented upon.

The authors arrive at the following conclusions:—

1*st*.—That the poison has no appreciable effect upon the nervo-muscular or central nervous system.

2nd.—The breathing is accelerated for a few minutes after the injection of the poison, but afterwards the number of respirations gradually decreases until death takes place.

3rd.—The final effect of the poison is to stop the heart in systole.

In the poisoned frogs the ventricle was contracted, empty, hard and white. In the mammal the left ventricle was smaller and harder than usual, the right ventricle less contracted and full of dark blood. Before final stoppage the heart symptoms may be divided into several stages. In mammals, at a certain period after the injection of the poison, a sudden want of rythm was observed, the heart beating very irregularly. Afterwards the pulsations became more and more feeble, with occasional stronger contractions, and finally periods of great depression alternating with periods of stronger pulsation were observed. In all cases a few auricular pulsations occurred after stoppage of the ventricles. It was remarked also that pulsation could be re-induced by mechanical or electrical stimulation of the heart muscle.

In the frog the first effect of the poison on the heart is a very marked doubling of the pulsations. Whereas in the normal condition the auricular contraction immediately precedes the ventricular, and is shown on the pulse tracing by a slight hitch in the curve of the total pulsation; in the poisoned animal the two pulsations are separated by a marked interval, and finally the auricular curve becomes so marked as to equal or even exceed in size the gradually decreasing ventricular curve.

In the second stage the ventricle only contracts once to several auricular contractions, that is, it only contracts when it has become sufficiently distended with blood to excite contractions.

In the last stage the strength of the auricular contractions gradually decreases, the ventricle remaining immovable, empty, and contracted. The authors conclude that the poison acts upon the intracardiac ganglia and not upon the central nervous system.

The poison, we are informed, is prepared by the natives of Tonquin from the leaves of *A. toxicaria*, and experiments made by the authors with the leaves of that plant prove clearly that they are the only active ingredient in the arrow poison. (*Archives de Phys.*, 1891, p. 373.)

A still more recent investigation of the Ipoh poison by Mr. L. Wray, the Curator and State Geologist of Perak, has been published in the *Perak Gazette*. He says:—The Samangs get the sap from the tree by scoring the bark. The sap is heated on a spatula till evaporated, leaving a dark gummy substance in which the arrows are dipped; 3½ ounces of sap will do for poisoning 100 arrow points. The sap was bitter and biting in taste and decidedly acid to test paper; when exposed to the air it darkens to a brown colour, and yields when dried 29 per cent. of Ipoh. If this substance is placed on a glass slide and examined under a microscope it is seen to contain numerous crystals of antiarin. Some fruiting specimens of the Ipoh were sent to Kew in 1883, and were pronounced to be identical with the Javan specimens of *A. toxicaria*. With reference to the two kinds of Upas distinguished by Blume as *Arbor toxicaria femina et mas*, the latter word in Malay means "gold"; it is so called from the golden colour of the inner bark. In the innocuous variety, so say the Samangs, the inner bark is blackish coloured, and so they distinguish the poisonous from the non-poisonous trees. They have never mixed arsenic with the sap. One fluid ounce of Ipoh sap was found to yield 10·85 grains of antiarin or 2·482 per cent. The dried Ipoh poison, of which the sap contains 29 per cent., therefore has 8·56 per cent. of antiarin in it. 0·086 of a grain of the dried poison is enough to kill an animal weighing 20 lbs., when introduced into the circulation. Fowls and pheasants are proof against the poison, but a cat struck with a poisoned dart died within 19 minutes. Mr. Wray's Report has since been published in the *Kew Bulletin* for October and November 1891.

Description.—The nuts are sub-globular, the size of a marble, of a light-brown colour, and have a slightly prominent umbilicus; they are enclosed in a sweet greenish-yellow pulp,

forming a small one-seeded fig with a rich purple bloom. The shell is thin and fragile, the kernel, loose inside the shell, is of the size of a large pea, brown, sub-globular, rugose, especially upon the flatter side; substance hard and very bitter.

Chemical composition.—When the sap of the tree is exhausted with boiling alcohol, a mixture of vegetable albumin, gum and wax remains undissolved, while a solution is formed, which throws down, on cooling, wax, antiar-resin, and albumin. On removing the sediment and evaporating, more resin and wax are deposited, and the solution dries up at last to an extract, from a solution of which in boiling water *Antiarin*, $C^{14}H^{20}O^{5}+2H^{2}O$, amounting to 3·5 per cent. of the dried sap, crystallises. The crystals are purified by washing and recrystallisation. Antiarin forms splendid silvery laminæ resembling malate of lime.

The flakes which separate from the alcohol after boiling it with the sap of *A. toxicaria*, consist of *Antiar-resin*, $C^{32}H^{24}O^{2}$, which may be obtained white by re-solution in boiling alcohol; when dry it has a glassy fracture, but becomes pasty if warmed. It is not poisonous, whilst antiarin causes death if introduced into the circulation in minute portions. (*Mulder in Gmelin's Handbook*, Vol. XVI., p. 217.)

The wax deposited on cooling from an extract of the juice prepared with hot alcohol, and purified by boiling with water, is white and brittle, softening at 30°, and melting at 35°, sp. gr. 1·016 at 20°. It is decomposed by nitric acid, blackened by sulphuric acid, and not affected by hydrochloric acid or potash-ley. It is soluble in alcohol and ether, especially on boiling. Average composition 77·29 per cent. Carbon, 11·71 H, and 11 O. (*Ibid.*, Vol. XVIII., p. 158.)

The seeds of the Indian plant, collected in Savant Vádi, contain a crystalline principle, very bitter and poisonous, resembling, if not identical with, antiarin. It is soluble in water, alcohol, and very slightly in ether. It gives a reddish-brown colour with sulphuric acid, and a yellowish or orange colour with nitric acid. On allowing the dried extract to stand, it does not readily crystallize out, but if the alcoholic extract is dissolved in water, in which it is quite soluble (showing

absence of resinous matter), and the solution agitated with crude ether, crystals can be obtained from the decanted ethereal layer. The solution also reduced Fehling's solution. About 2 per cent. of fat, 11·33 of water, and 3·46 of ash were separated from the air-dried seeds.

The juice of **Artocarpus integrifolia,** *Linn.*, the well-known Jack tree, in Sanskrit Panasa, heated over the fire, is a popular cement for joining broken China and stoneware. The deposit from the milky juice is insoluble in water, partly soluble in alcohol, and entirely so in benzol. It is a variety of caoutchouc, and in the natural state can be used as a birdlime, or as a cement for broken articles; after being washed in boiling water it becomes harder, and may be used for all the ordinary purposes of India-rubber. The yellow dye which is obtained from the wood is of a resinous nature, and may be extracted by boiling water or alcohol. The juice of **A. Lakoocha,** *Roxb.*, or one or two of the seeds, is a popular purge in Bengal; the tree is the Dahu of Sanskrit writers. Rheede states that the dry leaves and juice of **A. hirsuta,** *Lamk.*, together with zedoary and camphor, are applied to buboes and swelled testicles. The dried juice breaks with a resinous fracture, is only partly soluble in alcohol, wholly soluble in benzol and petroleum ether. The tree yields the Anjelly wood of South India, and is called Ayani in Malabar, where it is very abundant.

MYRICACEÆ.

MYRICA NAGI, *Thunb.*

Fig.—*Bot. Mag.*, *t.* 5727; *Wight Ic.*, *t.* 764, 765.

Hab.—Subtropical Himalaya. The bark.

Vernacular.—Kaiphal, Kátphal (*Hind.*, *Gus.*, *Beng.*), Kaya phala (*Mar.*), Marudam-pattai (*Tam.*), Kaidaryamu (*Tel.*), Marutam-toli (*Mal.*), Kirishivani (*Can.*).

History, Uses, &c.—The bark of this tree is its most valuable product, and is largely exported to the plains. It is called in Sanskrit Katphala, and bears among other synonyms those of Kumuda, Kumbhi-páki, Sriparnika, Somavalka, and Mahakumbhi. According to the Nighantas, it is useful in diseases caused by deranged phlegm, such as fever, asthma, gonorrhœa, piles, cough, and other affections of the throat. It is an ingredient in numerous formulæ for these diseases, such as the *Katphaladi churna*, for which Sarangadhara gives the following prescription:—Take of the bark of *M. Nagi*, tubers of *Cyperus rotundus* (Mustaka), root of *Picrorhiza Kurrooa* (Katuki,), *Curcuma Zedoaria* (Sati), galls of *Pistacia integerrima* (Karkata-sringi), and root of *Saussurea Lappa* (Kushta), equal parts; powder and mix. This powder is given in doses of about a drachm with the addition of ginger juice and honey in affections of the throat, cough and asthma. The powdered bark is used as a snuff in catarrh, and mixed with ginger as an external stimulant application in cholera, &c.

Under the names of Dár-shishaán, Kandúl, and Úd-el-bark, Mahometan writers state that the bark is resolvent, astringent, carminative, and tonic; that it cures catarrh and headaches; with cinnamon they prescribe it for chronic cough, fever, piles, &c. Compounded with vinegar it strengthens the gums and cures toothache; an oil prepared from it is dropped into the ears in earache. A decoction is a valuable remedy in asthma, diarrhœa and diuresis; powdered or in the form of lotion the bark is applied to putrid sores; pessaries made of it promote uterine action. The usual dose for internal administration is about 60 grains. *Duhn-el-kandúl*, an oil prepared from the flowers, is said to have much the same properties as the bark. We have never met with it, nor does it appear to be known in commerce.

Description.—Bark half an inch thick, externally scabrous, pitted from the separation of pieces of suber, of a mottled rusty-brown and dirty white colour, suber warty; substance of bark and inner surface of a deep dull red colour; when soaked in water it produces a deep red solution; taste strongly astringent.

Microscopic structure.—Within the suberous layer is a remarkable stratum of stony cells; the parenchyma throughout is loaded with red colouring matter, and permeated by large laticiferous vessels, from which a gummy latex exudes when the bark is soaked in water.

Chemical composition.—The bark of *M. Nagi* contains 14 per cent. of tannin, which gives a purplish colour with ferric salts, but the tincture and decoction give a greenish colour owing to the presence of colouring matter in the bark. The ash of the air-dried bark amounts to 7·17 per cent.

When the bark is exhausted by water and the water evaporated, a brittle shining extract is obtained of a reddish-brown colour, which contains 60 per cent. of tannin with some saccharine matter and salts.

Commerce.—The bazaars are supplied from Northern India; about 50 tons of the bark are collected annually in the Kumaon forests. It is always obtainable in native drug shops. Value about Rs. 2 per maund of 41 pounds.

CASUARINEÆ.

CASUARINA EQUISETIFOLIA, *Forst.*

Fig.—*Beddome, Forester's Man., t.* 226. Tinian Pine (*Eng.*), Filao de l'Inde (*Fr.*).

Hab.—East side of the Bay of Bengal. Cultivated elsewhere. The bark, leaves, and seeds.

Vernacular.—Sinyu (*Burm.*), Chouk (*Tam.*), Sarva (*Tel.*), Kásrike (*Mysore*), Aru (*Mal.*), Viláyati-saru (*Mar.*).

History, Uses, &c.—This tree is distributed through Chittagong, Burma, the Malay and Pacific Islands, and Australia, and is much cultivated on the coasts of India. In

Australia it is called the swamp oak. Dr. Bennett (*Gatherings of a Naturalist in Australia*) remarks:—"Their sombre appearance causes them to be planted in cemeteries, where their branches give out a mournful sighing sound, as the breeze passes over them, waving at the same time their gloomy hearse-like plumes." The wood from its red colour is called in the colonies *Beef-wood*, and is much used for fuel, and as a timber on account of its hardness. The bark is astringent, and the ashes of the tree yield a quantity of alkali. The bark is used by the Madras fishermen fŏr dyeing their nets. Rumphius notices the use of a decoction of the bark for a bath in Beri-beri, and of a decoction of the leaves in colic. The pounded seeds, he says, are used as a plaster in headache.

According to Corre and Lejanne (*Mat. Med. et Tox. Colon.*), the bark contains one-fifth of its weight of tannin and one-twelfth of *Casuarine*, resin, and colouring matter. A decoction, extract, tincture and syrup are used by the French in Tahiti, Cochin-China, and the Antilles as an astringent. We have observed that the tree yields an inferior sort of gum, not likely to be of much value on account of its deep colour and insolubility in water.

Description.—Bark never very thick, brittle, breaking with a coarse fibrous fracture, substance very hard, fibrous, and of a pink colour; internal surface striated; external surface covered with a scabrous grey suber, readily separating in flakes, and displaying a thin brown suberous layer closely adhering to the liber; taste strongly astringent; odour not peculiar.

Chemical composition.—The bark yielded 18·3 per cent. of tannic acid, giving a blue-black precipitate with ferric salts, and a bulky precipitate with gelatine. The alcoholic extract contained no alkaloidal principle, but a very small quantity of a crystalline neutral principle was shaken out of the watery solution of the extract by ether; it was not coloured by strong acids.

CUPULIFERÆ.

BETULA UTILIS, *Don.*

Fig.—*Regel Monogr.* 58, *t.* 6, *f.* 13-19; *t.* 13, *f.* 7-14; *Jacq. Voy. Bot.*, *t.* 158. Himalayan Birch (*Eng.*), Bouleau á papier (*Fr.*).

Hab.—Temperate Himalaya, Afghanistan.

BETULA ALNOIDES, *Ham.*

Fig.—*Brand. For. Fl.*, *t.* 56; *Regel Monogr.* 61, *t.* 6, *f.* 32-34; *t.* 13, *f.* 29.

Hab.—Temperate and subtropical Himalaya. The bark.

Vernacular.—Bhujpatar (*Ind. Bazaars*).

History, Uses, &c.—These trees require a brief notice, as the bark, in Sanskrit Bhurjapatra, is much used all over the country for writing medicinal charms on, and is to be found in every druggist's shop. This bark is well-known as the material upon which the ancient Sanskrit manuscripts of Northern India are written. Dr. Bühler, in his account of a tour in Cashmere in search of Sanskrit manuscripts, says:—"The Bhurja MSS. are written on specially prepared thin sheets of the inner bark of the Himalayan birch, and invariably in Sârada characters. The lines run always parallel to the narrow side of the leaf, and the MSS. present, therefore, the appearance of European books, not of Indian MSS., which owe their form to an imitation of the *Talapatras.* The Himalayas seems to contain an inexhaustible supply of birch-bark, which in Cashmere and other hill countries is used both instead of paper by the shop-keepers in the bazaars, and for lining the roofs of houses in order to make them water-tight. It is also exported to India, where in many places it is likewise used for wrapping up parcels, and plays an important part in the manufacture of the flexible pipe-stems used by hukâ-smokers. To give an idea of the quantities which are brought into Srinagar, I may mention that on one single day

I counted fourteen large barges with birch-bark on the river, and that I have never moved about without seeing some boats laden with it. None of the boats carried, I should say, less than three or four tons' weight.

"The use of birch-bark for literary purposes is attested by the earliest classical Sanskrit writers. Kalidâsa mentions it in his dramas and epics; Susruta, Varahâmihira (*circa* 500-550 A. D.) know it likewise. Akbar introduced the manufacture of paper, and thus created an industry for which Cashmere is now famous in India. From that time the use of birch-bark for the purpose of writing was discontinued, and the method of preparing it has been lost. The preparation of the ink, which was used for Bhûrja MSS., is known. It was made by converting almonds into charcoal and boiling the coal thus obtained with *gomûtra* (urina bovis); this ink is not affected by damp or water." (*Journal, Bombay Branch Royal Asiatic Society*, Vol. XII., No. XXXIV. A.)

QUERCUS INFECTORIA, *Olivier.*

Fig.—*Bentl. and Trim.*, *t.* 249; *Olivier, Voy. dans l'Emp. Oth.* ii., p. 64, *Atlas*, *tt.* 14, 15; *Steph. & Church*, *t.* 152. Dyers' oak (*Eng.*), Chêne à la galle (*Fr.*).

Hab.—Asia Minor, Syria, Turkey. The galls.

Vernacular.—Májuphal, Máphal (*Hind.*, *Beng.*), Maiphala, Mája (*Mar.*), Máshik-káy (*Tam.*), Máshi-káya (*Tel.*), Máchi-káyi (*Can.*), Mayaphal (*Guz.*).

History, Uses, &c.—The Sanskrit name for galls is Máyin or Máyika, and signifies "magic," the gall-nut being used in India in magic rites.

Galls were well known to the Greeks and Romans, who used them medicinally on account of their astringent properties.* India has probably been supplied with them from an early date, *viâ* the Persian Gulf, the greater portion being still shipped at Basra on board Arab vessels, hence the names Basra

* Compare with Dios., i. 127. περὶ κηκίδων; and Pliny, 16, 9, and 24, 5.

and Maka galls. The medicinal uses to which galls are put in India hardly differ from those with which we are familiar. The Hindus divide them into two kinds, black and white, and generally prescribe both kinds together in the same prescription. Mahometan writers direct the dark-coloured unperforated galls to be selected as the best.

The Arabs call them عفص (*afs*), and say that the tree, which is not of the land of the Arabs, bears one year galls and another Ballút (acorns). In Persia they are known as Mázú or Mázún; the author of the *Burhán* says they are used by tanners, و زنان هم گاهي بجهتِ تنگي موضع مخصوص بكار برند

In modern medicine tannic and gallic acids obtained from galls are generally used in preference to the raw material.

The action of tannin is chiefly local, and is due to its power of coagulating albumen; it is therefore a useful application when the skin has been deprived of its epidermis by diseases such as intertrigo, impetigo and eczema, as it forms with the exudations a protective coating, and at the same time contracts the cells of the skin.

When applied to a mucous membrane, it causes dryness, coagulation of mucus, and destroys to a great extent the sensibility of the membrane; on this account it is employed in stomatitis, sore-throat, and cough due to irritation at the back of the pharynx, and also as an injection in chronic discharges from the genito-urinary passages.

When taken into the stomach in large doses it causes irritation, and possibly vomiting, but in smaller doses it is often useful in hæmatemesis and intestinal hæmorrhage by coagulating the blood and thus acting as a styptic. In poisoning by the alkaloids it acts as a chemical antidote by forming tannates which are but sparingly soluble in the juices of the alimentary canal; it is also used as an antidote in poisoning by tartar emetic, with which it forms an insoluble tannate. When used as an antidote its administration should be followed by a purgative, as the tannates of the alkaloids will be partially redissolved, if allowed to remain in the intestines.

Dr. R. Stockman has conducted a series of careful experiments with gallic and tannic acids, with the object of determining the influences which the vegetable astringents exert upon the blood-vessels and animal tissues after absorption. He finds that tannic acid on its entry into the stomach forms alkaline tannates and tannates of albumin. A part of it, and sometimes the whole, is converted into gallic acid in the stomach and intestines, and it is difficult to find a trace of tannic acid in the blood, although it can be detected in the urine. Dr. Stockman comes to the conclusion that tannic acid enters the circulation in combination with alkalies and albumin, and is excreted with such rapidity that only a trace of its presence can be detected in the blood, but that its presence in the genito-urinary tracts and in greater quantity in the intestines can be readily shown. It does not appear to be excreted by the mucous lining of the air passages. It was found that the urine of dogs, rabbits, and human beings, after the administration of tannic acid, contained gallic acid and only a small quantity of tannic acid, but when tannate of soda was administered the urine contained a large proportion of tannic acid and but little gallic acid. These results may be explained in the following manner:—When free tannic acid is brought in contact with the contents of the stomach, it is chiefly converted into tannate of albumin, only a small quantity of alkaline tannate being formed. The tannate of albumin being very insoluble is retained for a long time in the intestines, until it is in a condition to be converted into gallic acid, in which form it is at length absorbed; on the other hand, the alkaline tannate is at once absorbed and passes off in the urine. Under these circumstances, the administration of tannate of soda naturally gives rise to the presence of a large proportion of tannic acid and a small proportion of gallic acid in the urine.

Dr. Stockman did not find pyrogallic acid in the urine, but this experience is in opposition to that of other experimenters.

When gallic acid was administered, that acid only was found in the urine.

According to Dr. Stockman, tannic acid exerts no action upon the urinary excretion, and gallic acid does not cause contraction of the blood-vessels, but on the contrary dilates them even after contraction has been induced by the action of an alkaline liquid. The neutral gallate of soda, in which form gallic acid circulates in the blood, was found to have no action upon the vessels.

Catechu-tannic acid and Rhatania-tannic acid gave the same results; tannic acid being insoluble in a solution of chloride of sodium could not be experimented with in this manner. Alkaline tannates and tannates of albumin did not affect the calibre of the vessels. Fikentscher has stated that tannic acid administered hypodermically to frogs stimulates the vaso-motar centres and increases the blood pressure, but Dr. Stockman found that gallate and tannate of soda administered in this way to rabbits did not affect the pressure. Pyrogallic acid yielded similar results.

As regards the therapeutic value of gallic acid as a local application or when absorbed into the blood, Dr. Stockman considers that it has no special astringent action, but that it diminishes the alkalinity of the blood and increases its tendency to coagulate: as a local application it is useless. Tannic acid precipitates albumin and forms a protective layer of tannate, which is advantageous in certain diseased conditions which we have already noticed. In its passage through the kidneys it is very doubtful whether it exerts any therapeutic action, but Ribbert considers that it lessens the exudation of albumin in albuminuria. Tannic acid is sometimes injected into the rectum to destroy thread worms, which it does by coagulating the albumin in their delicate tissues.

Description.— Two kinds of gall are found upon Oak trees, hard and soft; the former are the galls of commerce, and are produced by a Cynips which punctures the buds of the tree and deposits its egg in the puncture; the latter result from the puncture of an aphis.

Gall-nuts are globular or pyriform bodies, studded with numerous tuberosities; those which still contain the insect are

of a blackish or bluish-green colour and heavy; those from which the insect has escaped are of much lighter colour, generally yellowish-white, on one side a round hole may be perceived; they are also lighter in weight and less astringent. When a gall is cut in two a round cavity is seen in its centre, which may or may not be occupied by the insect; in the latter case a passage leads from the cavity to the exterior.

Microscopic structure.—The contents of the central cavity, if present, are seen to consist of a starchy parenchyme destined to supply food to the larva. The walls of the cavity are formed of stone-cells. The bulk of the gall consists of cells arranged in a radiating manner, many of them containing colouring matter and tannin. Towards the exterior of the gall the cells contain dark-coloured chlorophyl; on the very surface the cells are small and thick-walled and form a kind of rind.

Chemical composition.—The principal constituent of galls is tannin or tannic acid. The tannin of different plants possesses distinctive characters; that obtained from galls is known as gallo-tannic acid. It is identical with the tannin of *Rhus coriaria*, Linn. (Sumach).

Galls afford from 60 to 70 per cent. of tannin, and about 2 per cent. each of gallic and ellagic acids.

Commerce.—Galls are imported from Basra and the Persian Gulf ports. Value: White, Rs. 10 per maund of 37½ lbs.; Blue, Rs. 17. Imports about 1,400 cwts. yearly.

SALICINEÆ.

SALIX CAPREA, *Linn.*

Fig.—*Eng. Bot.*, 1488; *Reichb. Fl. Germ.*, *t.* 577. Great round-leaved Sallow, Goats' Sallow (*Eng.*), Marceau, Marsault (*Fr.*).

Hab.—Persia, Europe. Cultivated in N.-W. India. The bark, leaves, seeds, and flowers.

Vernacular.—Bédmishk (Indian Bazars).

History, Uses, &c.—The willow ἰτέα was well-known to the ancient Greeks, and the Greek name is considered to be cognate to the Sanskrit Vitika, the old German Wida, and the old English With or Withy. Herodotus (i.,194) mentions it, and Theophrastus (H. P. iii., 13) mentions two kinds, λευκὴ and μέλαινα. Dioscorides (i.,121) notices its astringent properties, and the various medicinal uses to which the bark, leaves, seed and juice were put. Pliny (17, 20) describes the cultivation of the willow, and (24, 9) its medicinal properties. The ancients considered it to be very cooling, "Porro impediunt et remittunt coitum folia salicis trita et epota"; it was also thought to occasion sterility in women. The concrete juice of the plant mentioned by Greek and Latin writers is considered by Fée to have been a kind of manna.

Ibn Sina, under the name of Khiláf, follows Dioscorides closely in his description of the medicinal uses of the willow, but he mentions the use of the flowers of *S. Caprea* separately under the name of Behramaj, a corruption of the Persian Behrameh. The Mahometan physicians all mention the juice or gum (صمغ) of the plant, and Haji Zein states that it exudes from the leaves. It is probably the substance described by M. Raby (*Union Pharm.*, May, 1889), under the name of *Bidenguébine* or "willow honey," said to be derived from the leaves and young branches of a willow, and to have a feebly saccharine taste.

In Persia *S. Caprea* is known as Bid-i-Balkhi, and its flowers as Bidmishk; willow bark is still a popular febrifuge in that country. Aitchison mentions the following species of Salix as occurring wild or cultivated in Persia:—*S. pycnostachya*, Anders., *S. acmophylla*, Boiss., *S. babylonica*, Linn., *S. Daviesii*, Boiss., *S. alba*, Linn., *S. songarica*, Anders., and *S. Caprea*, Linn.

In China and Persia the tree is considered to be symbolic of immortality. *S. babylonica* is planted in burial grounds in the latter country, and has been introduced into India by the Moghals for this purpose; among the Romans it was sacred to

Juno Fluonia. For an account of the funereal use of the willow in China, the reader is referred to Schlegel's *Uranographie Chinoise*, or De Gubernatis' *Myth. des Plantes*, article *Saule*.

The Persian settlers in India have introduced the flowers (*bidmishk*) and the distilled water (*ma-el-khilaf*) of *S. Caprea*, both of which are used by the upper classes of Mahometans and Parsees, who consider them to be cephalic and cardiacal, and use them as domestic remedies in almost every kind of slight ailment.

Raughan-i-bid, an oil prepared by boiling two parts of the distilled water with one of sesamum oil until the water has all evaporated, is a favorite remedy for cough.

For a long series of years the willow fell into disuse in Europe, but was again brought into notice in 1763 by the Rev. Mr. Stone, who published a paper on the efficacy of the bark of *S. alba* as a remedy for agues. The broad-leaved willow bark (*S. Caprea*) was subsequently introduced into practice by Mr. James, whose observations on its efficacy were afterwards confirmed by Mr. White and Mr. G. Wilkinson (*Pereira, Mat. Med.*, ii., Pt. 1, p. 337). Willow bark was formerly official in the London, Edinburgh, and Dublin Pharmacopœias, and was considered no bad substitute for cinchona in agues. *S. Caprea* is one of those willows which yield *salicin* and tannin, and is remarkable for its large yellow fragrant catkins.

Salicin, which was discovered in 1825, and first obtained in a pure state in 1830, was at first much vaunted as an antiphlogistic by Riess and others in those cases in which salicylic acid is now employed; it was also used as an antiperiodic in ague, and is said to have been found efficient in preventing the development of acute coryza and influenza, and in mitigating the symptoms of hay fever. It was usually administered in 10-grain doses frequently repeated. More extended experience, however, led to the conclusion that it has little or no influence ... temperature, and the drug gradually fell into disrepute ...iscovery of the antiphlogistic properties of salicylic

acid, when it was again experimented with by Ringer and Bury, who showed that it had no influence upon the temperature of healthy children. They observed that under full medicinal doses a dusky flush suffuses the face on slight excitement, while the expression becomes dull and heavy. Less constant symptoms are deafness, noises in the ears, frontal headache, trembling of the hands and quickened breathing. Very large doses occasion severe headache, marked muscular weakness, tremor and irritability, with a rapid and feeble pulse.

Description.—Catkins 1—2 inches long, thick, cylindrical, bright yellow, fragrant; bracts oblong, small; scales obovate, blackish, hairy; nectary ovate, papillary; stamens longer than the scales, with oblong yellow anthers; germ ovate-lanceolate, silky, on a hairy stalk; style hardly any; stigma oblong, thick, undivided. Bark purplish-brown externally, minutely downy when young, internally white; tough and fibrous.

Chemical composition.—Willow bark has been shown to contain *salicin*, wax, fat, gum, and a tannin which gives with ferric salts a blue-black precipitate, the liquid becoming purplish-red on the addition of soda. Johanson (1875) has also shown the presence of a kind of sugar having a slightly sweet taste and reducing alkaline copper solution with difficulty, and of the glucoside benzohelicin, $C^{20}H^{20}O^{8}$. Salicin, a glucoside, crystallizes in colourless plates or flat rhombic prisms, but it usually occurs in commerce in white glossy scales or needles. It remains unaltered in the air, is neutral to test-paper, inodorous, and has a persistently bitter taste. It is soluble in about 30 parts of water at 11·5° C., and is somewhat less soluble in alcohol. It dissolves in 0·7 part of boiling water and in 2 parts of boiling alcohol. (*United States Pharm*) Cold sulphuric acid dissolves salicin with a bright red colour; after the absorption of water from the air (but not after the addition of water or after being neutralized by an alkali), the solution deposits a red powder (*rutilin*), which after washing is yellowish-red, after drying blackish-brown, insoluble in water, alcohol,

and glacial acetic acid, and is coloured violet-red by alkalies. (*Braconnot.*) On warming salicin with somewhat diluted sulphuric acid and potassium bichromate, *salicylous acid* or *salicyl-aldehyd*, $C^7H^6O^2$, is given off, recognizable by its peculiar fragrance, resembling that of meadow-sweet (*Spiræa ulmaria*).

Salicin when digested with emulsin or saliva, or heated to 80°C. with dilute sulphuric acid, assimilates 1 molecule of water, and is split into glucose and *salicylic alcohol* or *saligenin*, $C^7H^8O^2$, which crystallizes in pearly tables, is easily soluble in hot water, alcohol, and ether, melts at 82°C., and sublimes at 100°C. Saligenin is characterized by yielding in solution a deep-blue colour with ferric chloride, and when boiled with dilute acids by being converted into a resinous body, *saliretin*, $C^{14}H^{14}O^3$, while oxidizing agents convert it into salicylous and salicylic acids. Cold nitric acid, sp. gr. 1·16, oxidizes salicin, with the production of *helicin*, $C^{13}H^{16}O^7$, which crystallizes in white needles, and is by ferments and dilute acids resolved into sugar and salicylic aldehyd. If nitric acid of sp. gr. 1·09 is employed, salicin yields *helicoidin*, $C^{26}H^{34}O^{14}$, which may be regarded as a compound of salicin and helicin. (*National Dispensatory.*) For a full account of these interesting reactions, the reader is referred to *Watts' Dict. of Chemistry*, Vol. V., p. 147.

Bidangubin or "willow honey" has been examined by Raby (*Union Pharm.*, May, 1889, p. 201). It affords about 12 per cent. of sugar, estimated as glucose, and a considerable quantity of a sugar crystallizing in opaque hard crystals like those of sugar of milk. It melts at 150° to a transparent liquid, and dissolves in 5·5 parts of water at 15° C. The formula is given as $C^{12}H^{22}O^{11}$. This sugar evidently possesses considerable affinity to melezitose, from which it differs, according to M. Raby, in not being efflorescent, and in the greater rotatory power of the glucose derived from it by inversion over that obtained from melezitose. The inversion by means of dilute hydrochloric acid also takes place more rapidly. He therefore proposes to call the new sugar *bidenguébinose*.

GNETACEÆ.

EPHEDRA VULGARIS, *Rich.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 539; *Bertolon. Miscell. xxiii., t.* 3.

Hab.—Temperate and Alpine Himalaya, Europe, W. and Central Asia, Japan.

EPHEDRA PACHYCLADA, *Boiss.*

Hab.—Western Himalaya, Afghanistan, E. Persia.

Vernacular.—*E. vulgaris*—Amsánia, Butshur, Cheva (*Punj.*), Khanda, Khama (*Kunawar*), Phok (*Sutlej*), Ma-oh (*Japan*). *E. pachyclada*—Hum, Huma (*Pers., Bomb.*).

History, Uses, &c.—These two species are hardly different; *E. pachyclada* is rather more robust than *E. vulgaris* and more scabrid. Of the former, Sir J. D. Hooker remarks:—"I can find no good characters in the spikes and flowers, except the more or less margined bracts." A specimen of the Persian plant kindly furnished to one of us by Mr. K. R. Cama of Bombay, was identified at Kew as *E. vulgaris*. Dried branches of the Huma are still brought from Persia to India for use in Parsi ceremonial, and it is considered to have medicinal properties. The plant was used by the ancient Arians, and is probably the same as the Soma of the Vedas. Aitchison (*Proc. Linn. Soc.*, x., 77) notices the medicinal use of *E. vulgaris* in Lahoul, and he and Griffith state that the ashes of *E. pachyclada* are used as a snuff and dye in Afghanistan. Dr. N. Nagai of Tokio, Japan (*Berl. Klin. Wochenschr.*, 1887, 706), first drew attention to the fact that *E. vulgaris* contains an alkaloid (*ephedrine*) which possesses the property of dilating the pupil of the eye, and which may be used in the place of atropine. T. V. Biektine (*Bolnitch. Gaz. Botkina*, 1891, No. 19, pp. 473—476) has brought to notice the use of a decoction of the stems and roots of *E. vulgaris* as a popular remedy for rheumatism and syphilis in Russia, and of the juice of the berries in affections of the respiratory passages. After

administering the decoction himself in a number of cases of rheumatism, acute and chronic, he comes to the conclusion that the plant is especially valuable in acute muscular and articular forms of the disease: the pain is relieved, the pulse becomes less rapid and softer, and the respiration easier. Within 5 or 6 days the temperature becomes normal, the swelling of the joints disappears, and after about 12 days' treatment the patient is cured. In several cases marked diuresis was observed before or about the time that the temperature began to decrease; the drug was also observed to improve the digestion and promote the action of the bowels. In chronic cases the action of Ephedra was less marked, and in two cases of rheumatic sciatica and osteo-myelitis hardly any effect was produced, but it is only fair to remark that antipyrine, salicylate of soda, antifebrine, salol, &c., also failed to afford relief in these two cases. The decoction used by Dr. Biektine was made with 3·85 grams of the drug to 180 grams of water. Kobert has shown that 0·20 gram of ephedrine injected into the veins of dogs and cats produces violent excitement, general convulsions, exopthalmia and mydriasis. (*Nouveaux Remèdes*, Aug. 8th, 1891.)

Description.—*E. vulgaris* is a low-growing, rigid, tufted shrub, with usually a gnarled stem and erect green branches which are striate and nearly smooth. Bracts connate to the middle, not margined, eciliate, rarely produced into minute linear leaves. Spikelets ¼ to ⅛ inch, subsessile, often whorled; fruiting with often fleshy, red, succulent bracts, 1 to 2 seeded. Seeds bi-convex or plano-convex.

E. pachyclada has the same characters, but is usually more scabrid. Sir J. D. Hooker remarks:—"I have many specimens from N.-W. India that I do not know whether to refer to *vulgaris* or *pachyclada.*" The twigs of these plants have a terebinthinate and astringent taste, and sections when magnified show the tissues to be loaded with an inspissated red juice.

Chemical composition.—Dr. N. Nagai (*Tokio Chem. Society*, through *Chem. Zeit.*, 1890, p. 441) obtained the alkaloid *Ephedrine* from the stem of *Ephedra vulgaris* (Ma-oh). Its

composition is $C^{10}H^{15}NO$; by oxidation the alkaloid is split into benzoic acid, monomethylamine and oxalic acid. *Isoephedrine*, melting point 114°C., is obtained by heating ephedrine, melting point 30°C., with hydrochloric acid in a closed tube to 180°C. The constitution of ephedrine is $C^6H^5CH^2$ CH ($NHCH^3$) CH^2OH, and that of isoephedrine is $C^6H^5CH^2C$ (OH) (NH CH^3) CH^3.

The hydrochlorate of ephedrine forms acicular crystals which are freely soluble in water. Mr. J. G. Prebble (1889) found the twigs of *E. vulgaris* to contain 3 per cent. of a tannin, giving a whitish precipitate with gelatine and acetate of lead, and a greenish precipitate with acetate of iron.

CONIFERÆ.

JUNIPERUS COMMUNIS, *Linn.*

Fig.—*Richard. Conif.* 33, *t.* 5; *Reichb. Ic. Fl. Germ.*, *t.* 535. Juniper (*Eng.*), Genévrier (*Fr.*).

Hab.—Western Himalaya, Persia. The fruit.

Vernacular.—Hab-el-a'ra'r (*Ind. Bazars*).

History, Uses, &c.—A'ra'r (عرعر) is a Persian word; the author of the *Burhán* notices a popular belief that the Juniper is the enemy of the Date tree, and that the two will not grow together in the same place. Abu Hanifeh states on the authority of an Arab of the people of the Saráh, who are possessors of the *a'ra'r*, that it is the same as the Abhal (the latter name is applied in modern Arabic to the Juniper and Savine). He adds that he knew it in his own country, and afterwards saw it in the province of Kazween, cut for firewood from the mountains, in the neighbourhood of Ed-Deylem, and that the fruit is eaten when ripe. *J. communis* is a native of Greece, and must therefore have been known to the ancient Greeks, but there is much difficulty in identifying the two species of 'αρκευθὶς mentioned by Dioscorides. The fruit of some

species of Juniper was, however, used by Hippocrates in certain disorders of the womb, and Dioscorides mentions its diuretic properties, its use in cough and pectoral affections, and also its digestive properties. The ashes of the bark were also applied locally in certain skin affections.

Ibn Sina closely follows Dioscorides and gives no additional information concerning the plant. The several kinds of Juniper growing on the Himalayas do not appear to be used medicinally by the Hindus, and the berries sold in the bazaars by Mahometan druggists are all imported from the west *viâ* Bombay.

In modern medicine Juniper is only used as a diuretic.

Description.—Juniper-berries are nearly globular, about ⅓ inch in diameter, dark-purplish, and covered with a bluish-gray bloom; the short stalk at the base contains one or two whorls of the small scales, and the apex is marked by three radiating furrows, which are surrounded by ridges enclosing a triangular space. The three, or by abortion one or two, bony seeds are ovate in shape, triangular above, have six to ten large oil-sacs on their surface, and are imbedded in a brownish pulp which likewise contains oil-cells. The berries have an aromatic somewhat balsamic odour, and a sweet, terebinthinate, bitterish, and slightly acrid taste.

Chemical composition.—Juniper-berries were analysed by Trommsdorff (1822), Nicolet (1831), Steer (1856), and Donath (1873). They contain from ½ to 2½ per cent. of volatile oil, about ·30 per cent. of sugar, resins amounting to 10 per cent., 4 of protein compounds, fat, wax, formic and acetic acids, malates, and *juniperin*, which is light-yellow, slightly soluble in water, freely so in alcohol and ether, and with a golden-yellow colour in ammonia. Ritthausen (1877) obtained from juniper-berries, containing 10·77 per cent. of water, only 14·36 per cent. of sugar, 3·77 of ash, and 31·60 of cellulose.

Oil of juniper-berries is colourless or pale greenish-yellow, limpid, but on exposure rapidly thickens and turns yellow, and ultimately reddish-brown, at the same time acquiring an acid

reaction; the fresh-distilled oil from old juniper-berries is thickish and light-yellow. Its specific gravity is about ·870, but varies between ·85 and ·90; it begins to boil at 155° C., or, if obtained from ripe berries, at 205° C. (Blanchet), has the peculiar odour of the berries and a warm, aromatic, somewhat sweetish and terebinthinate taste, shows a neutral reaction to test-paper, turns polarized light slightly to the left, and is slightly soluble in alcohol, forming with 10 or 12 parts of 80 per cent. alcohol or with 2 or 3 parts of officinal alcohol a more or less turbid solution; but it yields clear mixtures with carbon disulphide in all proportions. Iodine dissolves slowly in the limpid oil, but acts more energetically upon the thickened oil, sometimes producing fulmination; sulphuric acid colours it brown and red. Old oil of juniper contains formic acid, from which it may be freed by sodium carbonate and rectification.

The oil is a mixture of hydrocarbons of the general formula $C^{10} H^{16}$, which differ in their boiling-point, a portion boiling at 282°C. It yields with hydrochloric acid gas a liquid compound. (*Stillé and Maisch.*)

TAXUS BACCATA, *Linn.*

Fig.—*Wall. Tent. Fl. Nep.*, *t.* 57; *Griff. Ic. Pl. Asiat.*, 376; *Bentl. and Trim.*, *t.* 253. Yew (*Eng.*), If (*Fr.*).

Hab.—Temperate Himalaya. The leaves.

Vernacular.—Tálispatar (*Ind. Bazars*).

History, Uses, &c.—Under the name of Tálisa-pattra or Talipattra, Sanskrit medical writers describe a drug which has carminative, expectorant, stomachic, tonic and astringent properties, and is useful in phthisis, asthma, bronchitis, and vesical catarrh; the powdered leaves are given with the juice of *Adhatoda Vasica* (vasaka) and honey in cough, asthma, and hæmoptysis. A confection called *Talisadya churna* is prepared with Talispattra, black pepper, long pepper, ginger, bamboo-

manna, cardamoms, cinnamon, and sugar, and is used in the abovementioned diseases. The author of the *Burhán*, the oldest Persian Dictionary, which contains a large collection of Pahlavi words, mentions the same drug under the name of Tálisfar, and states that this name was applied by the Greeks to the leaf of the Indian Olive, or, according to some, to its root-bark. Ibn Sina speaks of it as an Indian bark, and describes its properties in the same manner as the Sanskrit writers; he states that Galen considers it to be possessed of hot and cold properties in equal proportion, but that others say it is hot and dry. Yahia bin Isa, the author of the *Minháj*, considers Talisfar to be the leaf of the Indian Olive; Ibn Baitar thinks that it is Mace. Haji Zein-el-attár identifies it with the μακερ of the Greeks, and says it is the root-bark of the Indian Olive, a bark thicker than China cinnamon and harder and of a darker colour, very astringent and slightly aromatic. The author of the *Makhzan-el-Adwiya* mentions the drug in two places, and identifies it incorrectly with the *Zarnab* of the Arabs; he also appears to confound it with *Hydrocotyle asiatica*. Speaking of Zarnab, he says, "it is also called *Rijl-el-jarád* (locust's foot). In Hindí it is *brahmi, barambhi* and *sapni*, and one kind of it is called *Manduparni* and *barahmi*, and the plant is called *Tális*, and the leaves, which are the same as Zarnab, are called *Tálispatr*. It is a plant with leaves broader than those of *Sátar-i-bari*, of a yellowish colour, and scented like a citron; the flower is yellow, and the plant is less than a cubit in height, with a quadrangular hollow stem; it has a pungent taste, and retains its properties four years. It grows in the hills of Fars, and is called *Sarv-i-Turkistáni;* it is also found in Hindustan and Bengal. * * * * It is hot and dry in the second degree, and has stimulant, astringent, stomachic, pectoral and digestive properties similar to cinnamon; the fresh juice is intoxicating; mixed with oil of roses or violets and introduced into the ear it cures cold headache. Substitutes, double the quantity of cinnamon, cubebs, cassia, or cardamoms.* * * *" Again, speaking of *Tálisfar*,* an article

* Under this name Royle obtained the leaves of Rhododendron lepidotum, which are highly aromatic. (*Antiq. of Hind. Med.*, p. 91.)

described as one concerning the identity of which there is much difference of opinion, the author of the *Makhzan* says, "perhaps it is the same as Zarnab, which is called Tális in Hindí, and which is the *narrow leaf of a tree of a dusty colour, externally and internally yellow.*" If we turn to the older Arabian writers, we find that we have no reason to identify Zarnab with Tálisapattra; they say that it is a certain perfume or certain sweet-smelling tree (*Kámús*), or a species of sweet-smelling plant (*Sihah*); it consists of slender round twigs, between the thickness of large needles and of writing reeds, black inclining to yellowness, not having much taste or odour, what odour it has, being of a fragrant kind like citron. (*Ibn Sína*, Book II.) According to the Turkish Kámús, it is the leaf of a sweet-smelling plant called رجل الجراد (locust's foot). Sprengel thought it was *Salix Ægyptiaca*. (Confer. *Hist. rei. herb.*, T. II., p. 270.) Zarnab is of the measure فعلل and is a genuine Arabic word. A rájiz says—

يا بابى انت وفوك الاشنب كانما ذر عليه الزرنب

"O with my father thou *shouldst be ransomed*, and thy mouth, that is cool and sweet, as though Zarnab were sprinkled upon it." (*Sihah.*)

In the tradition of Umm Zara, where it is said المس مس ارنب والريح ريح زرنب "the feel is the feel of a hare, and the odour is the odour of Zarnab," Ibn el Athír, author of the *Nihayeh*, says that it signifies saffron (*Madd-el-kamús*). Ainslie (ii., 407) considers Tálispatar to be the leaves and twigs of *Flacourtia cataphracta*, Roxb. Dr. U. C. Dutt, in his Hindu Materia Medica, states that the Tálispatar of the Calcutta shops consists of the leaves and twigs of *Abies Webbiana*, Lindl.* Dr. Moidín Sheriff gives the name of Tálishapatri to the leaves of *Cinnamomum Tamala*, Nees. It would appear, therefore, that it is uncertain at the present time what the Tálisapattra of Sanskrit writers is, and that in different parts of the country various drugs are used as substitutes for it.

* Webb's or purple-coned fir.

All the samples of the drug which we have obtained from Bengal, Northern, Western and Southern India have consisted of the leafy twigs of the yew chopped in lengths of from one to two inches.

The yew was known to the Greeks and Romans as a poisonous plant.* Modern enquiry has shown that the leaves and seeds are poisonous, but not the red pulp surrounding the latter. The leaves have, however, been recommended in doses of from 1 to 5 grains in epilepsy and other spasmodic affections. As an abortive they have been often administered, and have generally proved fatal to the woman, without causing the expulsion of the fœtus. Moderate doses given to animals occasion hurried breathing and palpitation of the heart, followed by recovery, and larger doses produce a similar effect followed by death from syncope. Very large doses appear to produce death by syncope without pain or spasm. According to Borcher's (1876) experiments, taxine reduces the pulse and respirations and causes convulsions, with fatal asphyxia. (Husemann.) After death the evidences of gastro-intestinal inflammation have generally been slight, the heart was usually empty, the kidneys strongly congested, and the blood less coagulated than usual. The effects produced upon man by poisonous doses of yew resemble those above mentioned as occurring in animals: after large doses the nervous irritation, exhaustion and gastric disturbance may be very trifling, the patient dying by syncope.

Description.—The drug consists of the small branches of the tree with their linear-lanceolate, narrow, rigid veinless leaves cut up into short length (1 to 2 inches). The male flowers are to be found upon some of the sprigs, and resemble those of the common yew. The wood of the larger stems is that of a yew, and not of a pine.

Chemical composition.—Statements have been made at different times as to the presence in the leaves and fruit of the yew (*Taxus baccata*) of an alkaloidal principle. In 1876 (*Pharm.*

* ταξος and σμιλαξ. Dios. 4, 80; Plin. 16, 20.

Journ., [3], vii., 894), Marmé described a crystalline alkaloid that he had separated from the leaves and fruit, which he named "*taxine*," and spoke of as being poisonous. It was obtained by treating an ethereal extract of the leaves and fruit with water acidulated with sulphuric acid and precipitating this solution with ammonia. Messrs. Hilger and Brande report (*Berichte*, xxiii., 464) that, working on the leaves in the same way, they have separated an alkaloid, which they failed to crystallize. This taxine melted at 82° C., and when heated in a glass tube gave off white fumes that condensed on the colder parts of the tube to oil-like drops that solidified on cooling, at the same time a characteristic aromatic odour was evolved. It dissolved in water in traces only, freely in alcohol and ether, with more difficulty in chloroform, and was insoluble in benzol. It was coloured intense purple-red by concentrated sulphuric acid and intense red-violet by Fröhde's reagent, and gave yellowish precipitates with the ordinary alkaloidal reagents, and white precipitates, insoluble in excess, with the fixed alkalies and ammonia. The salts of taxine are mostly readily soluble in water, but only the hydrochloride was obtained well crystallized, and this by passing a current of hydrochloric acid gas into a solution of the alkaloid in anhydrous ether. Analysis of taxine gave results corresponding with the formula $C^{37}H^{52}O^{10}N$, and its behaviour with ethyl iodide indicated that it is a nitrile base. The authors do not seem to have occupied themselves with the physiological action of taxine. (*Pharm. Journ.*, Mar. 29, 1890.)

Toxicology.—No cases of poisoning by this plant have been recorded in India, but considering its common use as a drug throughout the country, we cannot help suspecting that such accidents must have happened, especially as the native doctors do not appear to be aware of its poisonous properties. Several cases of poisoning by yew have occurred in England, most of which have ended fatally. The prominent symptoms were vomiting followed by narcotism, with, in some cases, convulsions and dilated pupils, respiration slowed; death usually by asphyxia, due to paralysis of the respiratory muscles.

PINUS LONGIFOLIA, *Roxb.*

Fig.—*Royle Ill.*, *t.* 85, *f.* 1; *Griff. Ic. Pl. Asiat.*, *tt.* 369, 370.

Hab.—Outer Himalayan Ranges. The turpentine.

Vernacular.—Saral, Chir (*Hind.*). The turpentine, Ganda-biroja (*Ind. Bazars*).

History, Uses, &c.—The wood, in Sanskrit Sarala, and the turpentine Sarala-drava, are mentioned as medicinal in Sanskrit works; plasters, ointments, and pastiles for fumigations are directed to be made from the turpentine. The latter, under the name of Ganda-biroja, or, more correctly, Gandah-birozah, is found in all the Indian bazars, and appears to have all the properties of ordinary turpentine, though differing from it in odour. It is chiefly used as a pectoral plaster like the pitch plaster of Europe, but it has also a reputation in veterinary practice as a remedy for mange. The *Vaids* obtain from it by distillation without water a limpid sherry-coloured oil having the peculiar odour of the drug, which they call *Khanno oil* in the Deccan; it is in much repute as a remedy for gleet or long-standing gonorrhœa.

Collection.—The Chir Pine, which is a large tree of Afghanistan and the North-West Himalayas, is the chief source of this turpentine. Atkinson, who describes its collection in Gurhwal and Kumaon, says that it is there called *Birja* and *Lisha* or *Lassa*,* and that there are two kinds collected, *viz.*, the *natural exudation* and *Bakhar-birja*,† which is obtained by making incisions in the sap-wood. The yield of a tree thus treated is said to be from 10 to 20 lbs. the first year, and about one-third the quantity the second year, after which the tree either dies or is blown down. (*Atkinson*, *Brandis.*)

* लासा lásá; Illit. lásha; any viscous exudation of plants.

† बाखल, बाखर, or बखर an enclosure, house, chamber. An allusion to the small chamber cut in the tree to receive the turpentine.

Description.—Gandah-birozah is a dirty-white opaque substance, of soft and sticky consistence, having a strong and peculiar odour, more aromatic than that of common turpentine; the leaves of some tree, which have evidently been used in collecting the turpentine, are usually found mixed with it in considerable quantity.

Chemical composition.—56 lbs. of the crude drug distilled with water yielded 8 lbs. of a colourless limpid oil, having the peculiar odour of Gandah-birozah. The resin remaining in the still was of a dull brown colour; after straining to remove impurities it was stirred with a small quantity of boiling water until hard, and afforded a very fair substitute for Burgundy Pitch, weighing 43 lbs.

The oil, according to Lyon, has a specific gravity of ·875 at 82° F.; it commences to boil at about 310° F., and is dextro-rotatory.

Pinus Khasyana, the Khasya Pine of Assam, yields a fine quality of turpentine. A full-grown tree gives as much as 68 lbs. of crude resin a year. The oil is very pure, and Dr. Armstrong in 1881, reported that it had the greatest amount of action on polarized light of any coniferous oil of turpentine he had examined.

Pinus Gerardiana, *Wall. Lamb. Pin. Ed.* 3, *t.* 79; *Royle Ill.* 353, *t.* 85, *f.* 2; *Cleghorn Pines of N.-W. Himal., t.* 4, a native of Afghanistan and Persia, yields the pine-nuts which are sold in the Indian bazars under the name of *Chilghozeh*, and are described in Mohometan medical works under the Arabic name of *Hab-el-sanaubar-el-kibár*. In Persia the tree is called *Sús* (سوس) and in Afghanistan *Chil* and *Zan-ghozeh*. Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia,* p. 152) states that the seeds are one of the great trade products exported from the district of Kost and the Kuram Valley to India; they have stimulating properties, and are considered useful in chronic rheumatic affections, and as an aphrodisiac. They are usually administered pounded with honey, in the form

of a confection; they are of a brown colour, about one inch in length, and have an oleaginous and terebinthinate flavour.

Church, "Food Grains of India," found the percentage composition of the seeds to be Water 8·7, Albuminoids 13·6, Starch 22·5, Oil 51·3, Fibre 0·9, and Ash 3·0.

CEDRUS LIBANI, *Barrel.* var. *Deodara.*

Fig.—*Hook. f. Nat. Hist. Rev. ii., t.* 1-3; *Forbes, Pinet. Wob., t.* 48, 49; *Griff. Ic. Pl. Asiat., t.* 364.

Hab.—N.-W. Himalaya. The wood.

Vernacular.—Deodár-ki-lakri (*Ind. Bazars*).

History, Uses, &c.—This tree, in Sanskrit Devadáru, Suradáru, Suradruma "tree of the gods," yields the Bhadrakashtha "auspicious wood," Sneha-viddha "impregnated with oil," which is used as a carminative, diaphoretic, and diuretic by the Hindu physicians in fever, flatulence, inflammation, dropsy, urinary diseases, &c. It is chiefly used in combination with other medicines, as in the following diuretic mixture:—Take of Devadáru wood, root of *Moringa pterygosperma* (Sigru), and *Achyrantes aspera* (Apámárga), one drachm each and reduce to a paste with cow's urine. To be given in ascites. (Chakradatta.) The wood is also ground to a paste with water and applied to the temples to relieve headache. A tar (*Kilan-ka-tel*) made by destructive distillation of the wood is a favourite remedy for skin diseases in Northern India; it is given internally in doses of about one drachm, and also applied locally. From the Sanskrit name Devadáru of this wood, it must not be confounded with the wood of *Erythroxylon monogynum*, known in Tamil as Devadārum, and which, on account of its odour, is called "Bastard Sandal." *C. Libani* is the Deodár of Ibn Sina, who states that it is called *Sanúbar-el-hindi*, and is useful in rheumatism, piles, palsy, epilepsy, gravel in the kidneys or bladder and *prolapsus ani.* Háji Zein-el-Attár states that its juice is used in

Harrán (Afghanistan) to tan leather (he doubtless alludes to the tar which is used in the Punjab to dress the inflated skins used for crossing rivers).

Description.—The wood sold in the bazars is of a light yellowish-brown colour, very heavy, and in thin sections translucent, owing to the large proportion of turpentine contained in it. It has an agreeable terebinthinate odour.

Preparation of the tar.—First, an earthen vessel (*ghara*), with a wide mouth, and capable of containing about 4 seers, is sunk in the ground. Next, a large *ghara* of about 12 seers' capacity is taken, and three small holes are drilled in its underside; it is then filled with scraps of the wood, and over its mouth another smaller jar is placed, and kept there by a luting of clay; and then both the jars are smeared over with a coating of clay. These two jars thus stuck together are next set on the mouth of the receiver sunk into the ground, and the joint is made tight by clay. Firewood is now heaped round the apparatus and lighted, and kept burning from four to eight hours. The jars are then separated and the tar removed. One seer (2 pounds) of wood yields about 2·6 chittaks (5½ ounces) of tar. (*Baden-Powell, Punjab Prod.*)

Chemical composition.—An alcoholic extract of the wood was spontaneously evaporated to dryness by exposure to air, and the extract agitated with petroleum ether, and the insoluble residue treated with caustic soda and agitated with ether.

The petroleum ether extract on spontaneous evaporation left a transparent, pale yellow varnish-like residue, with a very fragrant terebinthinate odour, which became hard on exposure in thin layers, but preserved a perfect transparency. This extract was treated with aqueous caustic potash and agitated with ether. The mixture after standing separated into three layers. The lowest stratum was of a reddish yellow colour, the middle darker in colour, and the small amount which floated above the ether of a bright light yellow tint. The ethereal layer on spontaneous evaporation, left a satiny mass of fragrant odour, which, on microscopic examination, consisted of interlaced

needles and narrow plates. On ignition an alkaline ash was left. In sulphuric acid it dissolved with a yellow colour, no change being induced by the addition of nitric acid to the solution or hydrochloric acid and phenol. In order to obtain this resin acid in a free state, an ethereal solution of the potash salt was agitated with dilute sulphuric acid. On spontaneous evaporation of the ether, the acid was left as a transparent varnish.

The middle layer mentioned above appeared to consist of a concentrated solution of the potash salt of the resin acid; the potash salt not being very readily soluble in ether. The aqueous stratum was treated with sulphuric acid and agitated with ether, the ethereal extract was yellow, and had a slight odour not unlike that of valeric acid.

That portion of the original alcoholic extract insoluble in petroleum ether, was now agitated with ether and aqueous potash. The ether left on spontaneous evaporation a transparent yellow extract, insoluble in water; soluble in alcohol with neutral reaction, and possessing a marked bitter taste. Sulphuric acid coloured the extract a bistre-red. The potash solution was mixed with sulphuric acid and agitated with ether; during agitation dark reddish flocks separated, which were insoluble in ether even after prolonged agitation. The ethereal solution left a yellow transparent residue. In alcohol the extract was soluble with bitter taste and acid reaction. In concentrated sulphuric acid it dissolved with a dark-red colour, the addition of concentrated hydrochloric acid afforded a colour of crushed strawberries, which became of a reddish violet on the addition of phenol. In aqueous potash the extract dissolved with a bright yellow coloration. Ferric chloride added to an alcoholic solution gave a dirty brown coloration. The flocks insoluble in ether were of a reddish-brown colour, brittle when dry, without bitterness in an alcoholic solution, acid in reaction, and affording similar reactions with sulphuric and hydrochloric acids and phenol, and ferric chloride and caustic potash, to the resin soluble in ether.

CYCADACEÆ.

CYCAS CIRCINALIS, *Linn.*

Fig.—*Richard, Conif.*, *t.* 24—26; *Bot. Mag.*, *t.* 2826 and 2827; *Rheede, Hort. Mal. iii.*, 9, *t.* 13—21.

Hab.—Malabar Coast, Dry Hills in W. Madras. Male bracts and flour.

Vernacular.—Jungli-madan-mast-ka-phul (*Hind.*), Madana-kama-pu, Kamappu, Chanang kay (*Tam.*), Rinbadam, Todda-pana Eentha kay (*Mal.*), Malabári-supari (*Mar.*).

History, Uses, &c.—The male bracts of this tree are used in Southern India as a narcotic, and are considered to be similar in medicinal action to the flowers of *Stereospermum suaveolens.* Both drugs are termed Madana-kama-pu or flowers of Kama, and are said to contain a property that intoxicates insects that rest upon them. The bracts are powdered up with other substances and made into a confection as an aphrodisiac. Flour is made from this tree both from the stem and the nuts. In Malabar the nuts are collected and dried for a month in the sun, beaten in a mortar, and the kernels form a flour which is called *Indum Podi.* It is reckoned superior to the flour of Caryota, but inferior to rice, and is only eaten by the hill-tribes, and by the poorer classes, who, from July to September, when rice is scarce, are in danger of perishing. It has often been confounded with true sago. Rheede states that the fruit bearing cone reduced to a poultice and applied to the loins removes nephritic pains.

Description.—The bracts as sold in the bazar are of the shape of a spear head, two inches long by half an inch broad, clothed at the back with much fulvous down. A subulate incurved point rises from the exterior upper angle of each of the scales. When the strobile first appears, they are closely pressed together like the germs in the pineapple, but as it lengthens by age, they become detached from each other. Filaments none; the anthers entirely covering the under surface

of the scales, one-celled, two-valved, opening round the apex on discharging the pollen. The starch of the pith resembles that of sago under the microscope.

Chemical composition.—The bracts or scales contain, in a dried state, much albuminous and mucilaginous matter soluble in water, but no alkaloid or other principle that would account for its reputed narcotic action.

ORCHIDEÆ.

ORCHIS LATIFOLIA, *Linn.*

Fig.—*Fl. Br.* 924; *Engl. Bot.* 33., *t.* 2308; *Reichb. Fl. Germ. xiii.*, *t.* 50. Marsh Palmate Orchis (*Eng.*).

Hab.—Persia, Afghanistan, Nepal, Cashmere, and Europe.

ORCHIS LAXIFLORA, *Lam.*

Fig.—? *Boiss. Fl. Orient. v.*, p. 71.

Hab.—Persia and Afghanistan. The tubers.

Vernacular.—Salab-misri, Salap-misri (*Hind.*), Shálá-mishiri (*Tam.*), Sálá-misiri (*Tel.*), Sálá-mishri (*Mal.*), Chále-michhri (*Beng.*), Sálama-misri (*Mar.*, *Guz.*).

History, Uses, &c.—Theophrastus (P. H. ix., 19), and Dioscorides (iii., 132, 133, 134, 135), mention several tuberous roots which were used by the Greeks under the names of Orchis or Serapias and Satyrion. It is not known exactly what all of these were, but it is certain that some of them were the tubers of different species of Orchis. Ορχις is described by the ancients as having a twofold root, formed of tuberosities which resemble the testes in appearance. The larger of these tuberosities, or, as some say, the harder of the two, taken in water, was thought to be provocative of lust; while the smaller, or, according to some, the softer one, taken in goat's milk, was considered to be

antaphrodisiac. The tubers were also used as a remedy for ulcerations of the mouth and pituitous discharges from the chest, and were taken in wine as an astringent.

Mahometan physicians describe Orchis tubers under the name of Khusyu-uth-thalab (or salab), "foxes' testicles," and state that the odour of them, when fresh, resembles that of *semen hominis*, and that they have an aphrodisiac effect if clasped in the hand. The dried tubers have a great reputation in the East as a nervine tonic and restorative, and are much prescribed in paralytic affections. It was formerly supposed that Oriental Salep was obtained from certain species of Eulophia, but the tubers of these plants have no resemblance to the commercial article, and Aitchison has now established the fact that the two plants placed at the head of this article yield the bulk of the Persian salep. *Eulophia campestris*, Wall., is, however, used locally in Northern India as a substitute for salep.

In Southern India the tubers of several species of Habenaria and Orchis are collected by people in the hilly districts and sold locally as salep, but they are usually small and variable in appearance.

Salep is now regarded in Europe as very nutritious; it tends to confine the bowels, and is, therefore, a useful article of diet for those who suffer from diarrhœa.

The mucilage is prepared by first macerating powdered salep in cold water, and gradually adding boiling water, with stirring, in the proportion of 5 grains of salep to the ounce. Instead of water, milk or some animal broth may be used. Salep jelly may be made as follows: Rub 60 grains of powdered salep with water in a mortar until it has swollen to four times its original bulk; then add gradually, and with constant stirring, 16 ounces of boiling water, and boil down to 8 ounces.

Ainslie states that salep has the property of depriving salt-water of its salt taste.

Description.—Oriental salep is of two kinds, palmate and ovoid; the former, which was once known in Europe as *Radix palmæ Christi*, is very highly esteemed by the Persians,

especially if of large size. The ovoid tubers are from 1 to 1½ inches in length, and, if of good quality, have a creamy white colour, or are somewhat translucent and of a horny texture. They have hardly any odour and an insipid mucilaginous taste. The tubers should be plump and not wrinkled. When magnified, the bulk of the tuber is seen to consist of a parenchyme, the cells of which contain either mucilage, or starch altered by heat; it is traversed by small fibro-vascular bundles.

Chemical composition.—The most important constituent of salep is a sort of mucilage, the proportion of which, according to Dragendorff (1865), amounts to 48 per cent.; but it is, doubtless, subject to great variation. Salep yields this mucilage to cold water, forming a solution which is turned blue by iodine, and mixes clearly with neutral acetate of lead like gum arabic. On addition of ammonia, an abundant precipitate is formed. Mucilage of salep precipitated by alcohol and then dried, is coloured violet or blue, if moistened with a solution of iodine in iodide of potassium. The dry mucilage is readily soluble in ammoniacal solution of oxide of copper; when boiled with nitric acid, oxalic, but not mucic, acid is produced. In these two respects, the mucilage of salep agrees with cellulose, rather than with gum arabic. In the large cells in which it is contained, it does not exhibit any stratification, so that its formation does not appear due to a metamorphosis of the cell-wall itself. Mucilage of salep contains some nitrogen and inorganic matter, of which it is with difficulty deprived by repeated precipitation by alcohol.

It is to the mucilage just described that salep chiefly owes its power of forming with even 40 parts of water a thick jelly, which becomes still thicker on addition of magnesia or borax. The starch, however, assists in the formation of this jelly; yet its amount is very small, or even *nil* in the tuber bearing the flowering stem, whereas the young lateral tuber abounds in it. The starch so deposited is evidently consumed in the subsequent period of vegetation, thus explaining the fact that tubers are found the decoction of which is not rendered blue by iodine. Salep contains also sugar and albumin, and, when fresh, a trace of volatile oil. Dried at 110° C., it yields 2 per cent. of ash,

consisting chiefly of phosphates and chlorides of potassium and calcium. (*Pharmacographia.*) Gans and Tollens have tested the oxidation products, and in *Annales*, **249**, 245 (*J. Chem. Soc.*, May 1889), they report : "On oxidation salep yields saccharic acid, but no mucic acid. No furfuraldehyde is obtained by distilling salep syrup with dilute acids. With phenylhydrazine and sodium acetate it forms a precipitate which can be separated by crystallization from the phenylhydrazine compounds of dextrose and mannose, results which show that the syrup contains dextrose and mannose, but neither galactose nor arabinose."

Commerce.—In Eastern markets salep is classed as palmate and non-palmate. The former kind only appears in small quantities, and is much more highly valued than the latter; in Persia it is called *Panjeh-i-sálab*, or "hand salab," a name which is corrupted into *Punjábi* in India. The ordinary salep of commerce is known as *Abushaheri* or *lasaniya*, "garlic-like"; it sells at Rs. 30 to 35 per maund of 41 lbs., according to quality, whilst the palmate variety fetches fancy prices; if very fine and white, from 5 to 10 rupees per lb. may be asked for it.

The salep of Madras is largely supplied from the Nilgiris, where it is collected by the Todas and other hill tribes. The tubers are boiled in water, and then dried in the sun until quite hard, and are sent into the market in coarse bags containing five maunds. In Ootacamund this salep sells for Rs. 5 to Rs. 6 a maund of 25 lbs., and in Madras it realizes about twice the price. Mahomedans all over Southern India use this salep for making conjees and the sweetmeat *hulwa.*

Imitation salep is largely manufactured in India; it is known as *Banawati salab* or *salam*, and is said to be made of pounded potatoes and gum.

EULOPHIA VIRENS, *Br.*

Fig.—*Bot. Reg.*, *t.* 573; *Wight Ic.*, *t.* 913; *Bot. Mag.*, *t.* 5579; *Roxb. Cor. Pl. i.*, *t.* 38; *Rheede, Hort. Mal. xii.*, *tt.* 25, 26.

Hab.—Bengal and Deccan Peninsula.

EULOPHIA CAMPESTRIS, *Wall.*

Hab.—Plains of India, Punjab, Oudh, Bengal, and Deccan.

EULOPHIA NUDA, *Lindl.*

Fig.—*Wight Ic., t.* 1690; *Rheede, Hort. Mal. xii., t.* 26?

Hab.—Tropical Himalaya and Deccan Peninsula. The tubers.

Vernacular.— Mán-kand, Amber-kand, Bhui-kákali (*Mar.*), Katou-kaida-maravara, Katou-theka-maravara (*Mal.*), Budbar, (*Beng.*), Goruma (*Hind.*).

History, Uses, &c.—The tubers of these plants are used indiscriminately by the natives. The vernacular name *Mán-kand* is derived from the Sanskrit *Manya,* which signifies "the neck," and the plant is so named from a supposed resemblance between its tubers and scrofulous glands in the neck; Mán (मान), the Marathi form of the word, is also applied to the scrofulous disease in the neck. The tubers are applied externally and given internally to remove the disease. They are also administered internally to those suffering from intestinal worms. Rheede says of *E. virens*:—"Succus radicis si supra arborem *Kansjira* inveniatur amarus est, alvum laxat, bilem promovet. Succus bulbi et foliorum omnem adustionem ex pulvere pyrio, oleo ferventi, vel igne causatam, cum sanguine canino mixtus, tollit. Pulvis venenum, sive externum sive internum expellit. Si supra arborem *Jara,* vermes intestinorum enecat, febri resistit, ventrioulum corroborat, flatus dissipit. Succus cum carne totius plantæ in formam cataplasmatis redactus apostemata emollit, et, sine dolore, ad maturitatem producit." Roxburgh describes *E. virens* under the name of *Limodorum virens,* but does not notice its medicinal uses. Aitchison (*Notes on Products of W. Afghanistan and N. E. Persia,* p. 68) says:—"*E. campestris* is by no means rare in the Punjab, Baluchistan, and Afghanistan. Its tubers are collected in the Punjab, and make up the ordinary Salep of Lahore. When the present railway bridge was being constructed over the Chenab, at Wazirabad,

some of the islands over which the bridge was built were one season covered with this Orchis, specimens of which were sent to me by Captain Clerk, and which are now in the Herbarium at Kew."* A parcel of the tubers of *E. campestris* was sent to one of us from the Native State of Sirohi, with the object of ascertaining their commercial value if collected as Salep; they were similar in form to those of *E. nuda*, but smaller, and bore no resemblance to the commercial article.

Description.—The tubers of *E. virens* are conico-obpyriform, surrounded with circular marks showing the insertions of old leaves; if they have been exposed to the air, as is often the case with the upper portion of the tuber, they are of a greenish colour, when not so exposed of a yellowish white. In the fresh state many fleshy fibres issue from the lower portion of the tuber. *E. nuda* has larger tubers, often much flattened, in structure and colour they resemble those of *E. virens*, the leaves are larger, and the flowers often purple, though in some specimens they are green like those of *E. virens*. The tubers of *E. campestris* are of a similar character. Under the microscope the gum cells are seen, and the exterior cells contain bundles of raphides. The small tubers exhibit starch granules, but in large tubers these are entirely absent.

Chemical composition.—The fresh tubers contain a large quantity of clear white mucilage, which is not precipitated by ferric chloride or neutral acetate of lead, but is precipitated by basic acetate of lead and alcohol. The mucilage, unlike that of salep, is not coloured violet by iodine solution. Nitric acid forms no mucic acid when allowed to act upon the gum. The ash of the dried tubers amounted to 3·6 per cent.

DENDROBIUM MACRAEI, *Lindl.*

Fig.—*Xen. Orchid. ii., t.* 118.

Hab.—Sikkim, Khasia Mts., The Concan, and Nilgiri Hills. The plant.

Vernacular.—Jivanti, Jiba-ság (*Hind.*), Jibai, Jibanti (*Beng.*), Jivanti (*Mar.*, *Guz.*).

History, Uses, &c.—This plant is the Jivanti of Sanskrit writers. In the Nighantás it bears the synonyms of Jivani, Jiva "life-giving," Jivaníyá "supporting life," Jiva-sreshtha, Sáka-sreshtha "best of herbs," and Yasas-vini "renowned." It is also spoken of as Jiva-bhadra and Mangalya "auspicious," and is described as cold, mucilaginous, light, strengthening, and *tridosha-ghna*, *i.e.*, a remedy for the disorder of the three humors of the body, bile, blood and phlegm, known to Hindu physicians as *tridosha*. The whole plant is used in decoction along with other drugs supposed to have similar properties; it must not be confounded with *Jivaka*, one of the *Ashtavarga*, which is a drug unknown to the modern Hindus. *D. Macraei* does not appear to have been noticed by any of the European writers upon Indian Materia Medica.

Description.—A much-branched plant, often found on Jambul trees; stems long and pendulous, knotty, and with many oblong pseudo-bulbs; leaf one, terminal, shortly oblong, on the terminating pseudo-bulb, four to eight inches long, sessile; flowers white, side lobes of lip sprinkled with red, solitary at the base of the leaf, one in front and one behind; middle lobe of the lip much dilated, and the disk with two longitudinal fleshy crests. This plant has from its coloration been well named *pardalinum* or panther-like by Reichberg.

Chemical composition.—The alcoholic extract of the dried roots and stems was mixed with water acidulated with sulphuric acid and agitated with petroleum ether, ether, and then rendered alkaline and reagitated with ether. The petroleum ether extract had an aromatic odour, and was of a yellow colour and soft consistence. In cold absolute alcohol the greater part dissolved with acid reaction; the insoluble residue was white, and had the characters of a wax. During agitation with petroleum ether, chocolate flocks separated.

The acid ether extract formed a waxy, transparent red varnish, which repelled water, and was insoluble in it. In absolute alcohol the extract dissolved with strong acid reaction. The extract was treated with caustic soda and agitated with

ether. The ether extract formed a yellow varnish indistinctly crystalline in places. By the action of acidulated water traces of an alkaloid were separated. The extract when acted upon by cold absolute alcohol afforded a bright yellow solution without bitter taste; the portion of the extract insoluble in cold alcohol was white, by heating with alcohol it dissolved, and on cooling white woolly flocks separated, which on microscopic examination presented the appearance of interlaced hair-like masses. The amount of this principle was very small and its nature could not be determined. The alkaline solution of the original ether extract was acidulated and reagitated with ether, which left on separation a red transparent waxy varnish, insoluble in water, easily soluble in cold absolute alcohol with strong acid reaction and bitter taste. This principle had the properties of a resin acid, and we propose terming it β *Jibantic acid.* The alkaline ether extract contained traces of a white alkaloid without bitterness, crystallizable from ether, and giving a faint yellow coloration with Fröhde's reagent in the cold, deepening slightly on warming; no reaction with nitric acid. We provisionally call this alkaloid *Jibantine.* This alkaloid appeared similar to the one contained in the acid ether extract.

The chocolate-coloured flakes referred to as having separated on agitation with petroleum ether, were repeatedly agitated with ether, which on evaporation afforded a small amount of extractive similar to the original acid ether extract. The insoluble flocks were then dissolved in caustic soda and reagitated with ether, the ether affording a small amount of extractive. The alkaline solution was rendered acid and reagitated with ether, which separated a certain amount of a bitter acid resin, similar to the one we have termed β Jibantic acid, while chocolate flocks remained insoluble.

β Jibantic acid when freshly precipitated from an alkaline solution by acids would appear to be easily soluble in ether, but the flocks after standing become less soluble. The chocolate flocks just referred to were repeatedly agitated with ether, dissolved in caustic soda, precipitated with acid, and reagitated

with ether, in order to separate β Jibantic acid. Finally the flocks insoluble in ether were dissolved in alcohol, which afforded a red solution with only sight bitterness. We provisionally call this acid α *Jibantic acid.*

The chief points of difference and resemblance between these two acids may be summarized thus—bitterness, and easy solubility of the β acid, when freshly precipitated, in ether: slight bitterness and insolubility of the α acid, when freshly precipitated, in ether. The β acid is precipitated in lighter coloured flocks from an alkaline solution than the α acid. Both acids are soluble with equal readiness in alkalies and cold absolute alcohol.

VANDA ROXBURGHII, *Br.*

Fig.—*Bot. Reg., t.* 506; *Wight Ic., t.* 916; *Fl. des Serres,* ii., *t.* 11; *Reichb. Fl. Exot., t.* 121.

Hab.—Bengal, Behar, Guzerat, Concan to Travancore. The roots.

SACCOLABIUM PAPILLOSUM, *Lindl.*

Fig.—*Bot. Reg., t.* 1552.

Hab.—Bengal and the Lower Himalaya, Assam, the Gangetic Delta, the Circars and Tenasserim. The roots.

Vernacular.—Rásna (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. ii, p. 260) that we consider it probable that the original Rásna of the Arians was *Inula Helenium,* as the two drugs at the head of this article are notably deficient in the properties ascribed to Rásna by Sanskrit writers; for instance, the plants under consideration cannot be described as Gandha-mula "having a strong smelling root." Dutt (*Mat. Med.,* p. 258) remarks:—"Under the name of *rásna,* the roots of *Vanda Roxburghii* and *Acampe papillosa* are both indiscriminately used by native physicians. They are very similar in the appearance of their roots and leaves, though they differ much in their flowers and

fruit. One native physician whom I consulted, pronounced both of these plants to be *rásna*; when, however, I showed him the different flowers and fruit of the two species, he was puzzled." The description of the properties and uses of rásna will, we think, convince our readers that the original drug was not what is now used.

Rásna is said to be bitter and fragrant, and useful in rheumatism; the *Rásnapanchaka* is a decoction of *rásna; Tinospora cordifolia*, wood of *Cedrus Deodara*, Ginger, and root of *Ricinus communis*, of each equal parts; it is a popular prescription for rheumatism. *Rásna guggulu* is a *ghrita* composed of eight parts of *rásna* and ten of bdellium beaten into a uniform mass with clarified butter; it is given in drachm doses in sciatica. *Rásna* is also an ingredient of several oils used for external application in rheumatism and neuralgia, such as *Mahámásha taila, Madhyama Naráyana taila, &c.* *Vanda* is a general name in Sanskrit and the vernaculars for parasitic plants; other Sanskrit names for these plants are *Vrikshádani* and *Vriksharuha* "growing on trees." They are further distinguished by the addition of the names of the tree on which they grow, thus *Amara-vanda* would signify the *Vanda* of the *Amara* or mango.

Description.—*V. Roxburghii.*—Stem climbing, 1—2 feet; leaves 6 to 8 inches long, præmorse, narrow, complicate; peduncle 6 to 8 inches, 6 to 10-fid; sepals and petals yellowish-green or bluish, except from the clathrate-brown nerves, margins white, lip half as long as the sepals or more, disk of mid-lobe convex with fleshy ridges and white margins and mesial lines, spur conical.

S. papillosum.—Stem climbing, 2 to 3 feet; leaves 3 to 4 inches long, obliquely notched, narrow, complicate; scape 1 to 2 inches, closely scarred at the base, internodes close, bracts semicircular; flowers ¾ of an inch in diameter, mid-lobe of lip ovate, spur conical, pubescent within, petals yellow marked with red lines, lip white.

In the Concan *S. Wightianum*, Hook. f., *Rheede, Hort. Mal.* xii., *t.* 4, and *S. præmorsum*, Hook. f. *Rheede, Hort. Mal.* xii.,

t. 4, very similar plants, are used as Rásna. The Marathi peasants call these plants *Kánbher*.

Ordinary bazar Rásna both in Calcutta and Bombay consists of long branching roots, having something the appearance of sarsaparilla, but of a dark greyish-brown colour. The bark is thin and marked by numerous longitudinal furrows, the substance of the root light-brown and very fibrous ; a transverse section shows the woody portion to be arranged in wedge-shaped bundles. The root is inodorous, and has a starchy bitterish and astringent taste.

In Bombay a second kind of Rásna is sold at a much higher price, which bears no resemblance to the ordinary commercial article ; it occurs as straight pieces of a root about the size of a crowquill at the thickest part, gradually tapering to a point, and tied up in small bundles with thread. This root is of a light brown colour, with a thick and very hard bark; it has a faint peculiar odour when powdered, which recalls that of ipecacuanha. It is called *Khadaki-rasna* in Bombay. Under this name we have also received the roots of *Tylophora asthmatica*.

Chemical composition.—The standard *Rásna* of the Indian bazars yielded the following principles when an alcoholic extract of the whole dried plant was treated in a similar manner to that described under *Jibanti* p. 390: α—resin acid of a chocolate colour, insoluble in petroleum ether and ether: β—resin acid soluble in ether: neutral yellow resin: an alkaloidal principle: a white neutral principle: a neutral fluorescing principle. In physical and chemical properties the first five principles were similar to those described under *Jibanti*. An examination of the more expensive *Rásna* of the Bombay market gave the following results :—

A tincture prepared with 80 per cent. alcohol, gelatinized on concentration, after separation of the whole of the alcohol, the extract was agitated with amylic alcohol, and water acidulated with acetic acid. Amylic alcohol was selected for the first extraction, because preliminary experiments indicated that when petroleum ether or ether was used for agitation with an

aqueous solution of the alcoholic extract, the liquid formed an emulsion which showed little or no tendency to separate. The amylic alcohol tincture was evaporated on a water bath, and, when dry, was repeatedly agitated with ether, until colouring matter ceased to be dissolved. The extract insoluble in ether was then redissolved in amylic alcohol and agitated repeatedly with baryta water, until the baryta water ceased to be colored yellow. During agitation a soft varnish-like mass separated and adhered to the sides of the bottle. By this treatment the original amylic alcohol extract was separated into three fractions: (1) The amylic alcohol solution, (2) the varnish-like residue adhering to the sides of the bottle, and (3) the baryta water solution.

(1) The amylic alcohol solution on evaporation left a solid residue, which, after being pounded, and agitated with ether, to remove traces of adherent amylic alcohol, possessed the properties of a saponin-like principle; it frothed considerably with water; treated with concentrated sulphuric acid, a dirty reddish coloration was slowly developed; in water and aqueous ammonia it was only slightly soluble, but dissolved easily in ordinary acetic acid. As extracted the principle was not pure, it contained colouring matter and barium.

(2) The varnish-like residue was dissolved in acetic acid and agitated with amylic alcohol, the extract being treated with ether to remove traces of amylic alcohol. This extract also behaved like a saponin-like principle: after purification it formed a yellowish powder, it frothed considerably with water; treated with concentrated sulphuric acid, it developed in a shorter period than the first extract a beautiful bright carmine coloration: in water it was easily soluble, a concentrated solution having much the physical appearance of an aqueous egg albumen, and it dissolved readily in aqueous ammonia.

(3) The baryta water solution contained much colouring matter and a small amount of a principle which frothed with water, which was probably a mixture of the two principles already mentioned.

The original aqueous solution of the alcoholic extract left after agitation with amylic alcohol was acidulated with acetic acid and agitated with ether. The ether extract contained a neutral resin-like principle, a very bitter resin acid, the bitter taste of the drug being probably due to this resin, and a white crystallizable acid.

Finally, the acid aqueous solution was treated with sodic carbonate in excess and reagitated with ether. The ether separated traces of an alkaloidal principle, which afforded a faint yellow coloration with Fröhde's reagent, deeping slightly on heating.

Vanda spathulata, *Spreng.*, is the *Ponnampou-mara-vara* of Rheede (12, 3), and is supposed on the Malabar Coast to temper the bile and abate phrenzy, and the golden yellow flowers, reduced to powder, are given in consumption, asthma, and mania. (See Ainslie, *Mat. Med.*, ii., 321.)

Rhynchostylis retusa, *Blume*, is also mentioned by Rheede (xii., 1), also **Cymbidium tenuifolium** (xii., 5 and 6) and *C. ovatum* (xii., 7), as emollients. **C. aloifolium** (xii., 8) is said to be emetic and purgative.

SCITAMINEÆ.

CURCUMA AROMATICA, *Salisb.*

Fig.—*Salisb. Parad.*, *t.* 96; *Rosc. Scit.*, *t.* 103; *Wight Ic.*, *t.* 2005; *Bot. Mag.*, *t.* 1546. Wild Turmeric, Yellow Zedoary, Cochin Turmeric (*Eng.*), Zedoaire jaune (*Fr.*).

Hab.—Throughout India, wild and cultivated. The tubers.

Vernacular.—Jangli-haldi, Ban-haldi (*Hind.*), Ban-halad (*Beng.*), Rán-halad, Vedi-halad (*Mar.*), Amba-halad (*Guz.*), Kashturi-manjal (*Tam.*), Kasturi-pasupa, Kattu-mannal (*Tel.*), Kasturi-arishina, Kad-arishina (*Can.*).

History, Uses, &c.—This plant is the Vana-haridra or "wild turmeric" of Sanskrit writers. The Arabian and Persian physicians do not notice it, and probably did not distinguish it from turmeric. Roxburgh and Ainslie wrongly supposed it to be the Jadwar of the Arabians (see Vol. I., p. 20). It is the turmeric-coloured zedoary of Ainslie, who states that the Mahometans of Southern India suppose it to be a valuable medicine in snake-bite, administered in conjunction with golden orpiment, costus, and ajwain seeds. Guibourt (ii., p. 214) calls it *Zedoaire jaune*, and states that the plant which produces it has been well described and figured by Rumphius, and is his *Tommon bezaar* or *Tommon primum*, which has been wrongly referred by most writers to the *Curcuma Zedoaria* of Roscoe. *C. Aromatica* is identical with the Cassumunar described by Pereira (*Mat. Med.*, Vol. II., Pt. I., p. 236), and the "Cochin Turmeric" noticed by Flückiger and Hanbury (*Pharmacographia*, p. 580). The properties of this drug are very similar to those of turmeric, but its flavour being strongly camphoraceous is not so agreeable. It is used medicinally by the Hindus, in combination with other drugs, as an external application to bruises, sprains, &c., and is applied to promote the eruption in the exanthematous fevers; it is seldom used alone, but is combined with astringents when applied to bruises, and with bitters and aromatics to promote eruptions; it is never used as a condiment in India, but a kind of arrowroot is prepared from the tubers in Travancore. The plant under favourable circumstances produces central tubers as large as a small turnip. One of us has had it under cultivation for some years; the leaves when young have a central purple stain, which almost disappears when they attain their full size. The flowers appear in May or June, with the first leaves, just before the the rainy season.

Description.—Central rhizome oblong or conical, often more than two inches in diameter, external surface dark-grey, marked with circular rings and giving off many thick rootlets; at the ends of some of them are orange-yellow tubers about the size and shape of an almond in its shell; lateral rhizomes about

as thick as the finger, with a few fleshy rootlets. Internally both central and lateral rhizomes are of a deep orange colour like turmeric; the odour of the root is strongly camphoraceous.

Microscopic structure.—Similar to that of turmeric.

Chemical composition.—The drug yielded to analysis :—

Ether extract (essential oil, fat, and soft resins)...	12·06
Alcoholic extract (sugar, resins)	1·14
Water extract (gum, acids, &c).	6·50
Starch	23·46
Crude fibre	8·42
Ash	4·46
Moisture	13·33
Albuminoids, modifications of arabin, &c.	30·63
	100·00

The root had an odour of ginger; curcumin was present. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid.

Commerce.—The plant is chiefly grown at Alwaye, North-east of Cochin, and is also collected in Mysore, Wynaad, and other localities in Southern India for export to Europe as a substitute for turmeric to be used in dyeing. It is exported from Cochin and Bombay. Value, Rs. 24 to 25 per candy of 5¼ cwts. for the unpeeled root, Rs. 27 to 28 when peeled.

A European firm of Druggists in Bombay, writing to London for the ingredients to make Warburgh's fever tincture, was supplied with this article as Zedoary.

Exports of Turmeric from Cochin :—

	Europe, &c.	India, Burma, &c.	Total cwts.
1884-85	5,154	6,361	11,515
1885-86	7,610	2,776	10,386
1886-87	6,031	1,967	7,998
1887-88	2,356	2,039	4,395
1888-89	459	1,817	2,276
1889-90	2,013	6,704	8,717

CURCUMA ZEDOARIA, *Rosc.*

Fig.— *Rosc. Scit., t.* 109; *Roxb. Cor. Pl., t.* 101; *Rheede, Hort. Mal. xi., t.* 7. Zedoary (*Eng.*), Zedoaire (*Fr.*).

Hab.—Eastern Himalaya, cultivated throughout India. The tubers.

Vernacular.—Kachúra (*Hind., Beng., Mar., Can., Guz.*), Kichilick-kizhanghu, Pulan-kizhanga (*Tam.*), Kichili-gaddala, Kachoram (*Tel.*), Kacholam, Kachuri-kizhanna, Pula-kizhanna (*Mal.*).

History, Uses, &c.—This plant is the Sati and Krachura of Sanskrit writers, and the Zerumbád and Urúk-el-káfúr, "camphor root," of the Arabians. It is noticed by the later Greek physicians under the name ζουρομβέδ, a corruption of the Arabic name, which, in the Middle Ages, was variously written as Zeruban, Zerumber, and Zerumbet. It is not the ζέδοαρ of Ætius (A. D. 540—550) or the τζετὀυαριον of Myrepsus, or the Zedoar of Macer Floridus (A. D. 1140). Barbosa (1516) speaks of *Zedoaria* and *Zeruban* as distinct articles of trade at Cannanore, so that it must have been some time after this date that Zerumbet came into use in Europe as a cheap substitute for the Zedoar of the earlier physicians, which, we have no doubt, was the same drug as the Jadwar of the Arabians. This name, correctly written by Ætius, is the زد وار (Zhedwar) of the ancient Persians, and is described in the *Burhán* (A. D. 1046) as a drug used as an antidote to poisons, the same as the Jadwár of the Arabians, and also called *Mahparvin.* Ibn Sina of Bokhara, who lived about the same time (980—1037), describes Jadwár shortly in the following words:— الماهية قطع يشبه الزراوند و ادق منه —"it has the form of the root of Aristolochia, but is smaller." Haji-Zein-el-attár, the well-known Persian physician and apothecary, and the author of the "Ikhtiarát" (A. D. 1368), describes Jadwár as a root about the size and shape of the Indian Cyperus root, but harder and heavier, and the same as the Indian drug Nirbisi, the best internally of a purplish tint. He states that there

are, as far as his experience goes, four drugs sold as Jadwár, viz., a white kind, a purplish, a black and a yellow; the people of Cathay call the yellow kind *Kurti* and the purplish *Burbi*, the other two kinds come from India. As to the locality in which the drug is collected, he states that there is a mountain called Farájal between India and Cathay, where the plant grows along with the aconite, and that the latter, whenever it grows near the Jadwár, loses its poisonous properties and is eaten with impunity by the inhabitants. Where the Jadwár does not grow, the aconite (Bish) is a deadly poison, and is called *Haláhal* by the natives (Halahala, Sanskrit). In the *Dict. Econ. Prod. of India* (ii., p. 656), the following interesting account of certain drugs collected in Nepal by Dr. Gimlette, the Residency Surgeon, substantially confirms Haji-Zein's description of Jadwár or Nirbisi:—According to Dr. Gimlette, "the *Kala bikh* of the Nepalese (the *Dulingi* of the Bhoteas) is a very poisonous form of *Aconitum ferox*, so poisonous, indeed, that the Katmandu druggists will not admit they possess any. *Pahlo* (yellow) *bikh* is a less poisonous form of the same plant, known to the Bhoteas as *Holingi*, while *Setho* (white) *bikh* (the *Nirbisi sen* of the Bhoteas) is *A. Napellus*, and *Atis* is *Aconitum heterophyllum*. The aconite adulterants or plants used for similar purposes are, *Cynanthus lobatus*, the true *Nirbisi* of Nepal, the root of which is boiled in oil, thus forming a liniment which is employed in chronic rheumatism, *Delphinium denudatum*, the *Nilo* (blue or purplish) *bikh* of the Nepalese and the Nirbisi of the Bhoteas, Dr. Gimlette says, is used by the *Baids* of Nepal for the same purposes as the *Setho* and *Pahlo bikh*. *Geranium collinum* (*var-Donianum*) is the *Ratho* (red) *bikh* of the Nepalese, and the *Nirbisi-num* of the Bhoteas, and, like the *Setho bikh*, is given as a tonic in dyspepsia, fevers, and asthma. Lastly, a plant never before recorded as used medicinally, namely, *Caragana crassicaulis*, is known as the *Artiras* of the Nepalese, and the *Kurti* of the Bhoteas; it affords a root which is employed as a febrifuge."

The Jadwár or Nirbisi myth appears to have been invented in the East to account for the curious occurrence on the

Himalayas of poisonous and non-poisonous aconites growing side by side (see Vol. I., pp. 1, 15, 18, 20).

It would appear also that the Curcumas have no claim to the name of zedoary, which was probably first given to them about the middle of the 16th century, as Clusius's figure of Gedwar is certainly meant for the pendulous tuber of a Curcuma. The substitution of the cheaper for the more expensive article is rendered highly probable by the fact that Zerumbet was considered by the Arabians to be very little inferior to Jadwár as an antidote to poisons. Ibn Sina, Ibn Baitar, and Ibn Jazla in the *Minháj* use almost the same words in speaking of these drugs; of Jadwár they say:—هو ترياق السموم باسرها حتي البيش والافاعي, "it is an antidote for all poisons, even those of aconite and the viper"; and of Zerumbet—من ينفع لنزع الهوام جدا حتي يقارب الجدوار "it is most useful against the bites of venomous animals, and is almost equal to Jadwár." Both drugs were considered to have properties similar to *Darunaj* (see Vol. II., p. 292). Ainslie (*Mat. Ind.*, i, 492) remarks that *C. Zedoaria* is the *Lampooyang* of the Javanese, and the *Lampuium* of Rumphius (*Herb. Amb*, V., p. 148), and that it is a native of the East Indies, Cochin-China, and Otaheite. He quotes Geoffroy's description of the drug, which leaves no doubt as to its identity with the modern Kachora—"Foris cinerea, intus candida; sapore acri-amaricante aromatico; odore tenui fragrante, ac valde aromaticum suavitatem, cum tunditur aut manducatur, spirante et ad camphoram aliquatenus accedente." Guibourt states that *C. Zedoaria* is the Zerumbet of Serapion, Pomet, and Lemery. The following is his description of it:—"The round zedoary is greyish-white externally heavy, compact, grey and often horny internally, having a bitter and strongly camphoraceous taste, like that of the long zedoary, which it also resembles in odour. The odour of both drugs is analogous with that of ginger, but weaker unless the rhizome be powdered, when it developes a powerful aromatic odour, similar to that of cardamoms." (*Hist. Nat.* 6me Ed., Vol. II., p. 213.) In our opinion there is no doubt that *C. Zedoaria* is the source of the round and long zedoary of commerce. The plant is common in Bombay gardens, and

was probably introduced by the Portuguese, whose descendants and converts at the present day use the leaves in cookery, especially with fish. From Dr. Hové's account of Bombay in 1787 it appears that Kachúra and Turmeric were cultivated at that time in the cocoanut woods at Mahim. The natives chew the root to correct a sticky taste in the mouth; it is also an ingredient in some of the strengthening conserves which are taken by women to remove weakness after child-birth. In colds it is given in decoction with long-pepper, cinnamon and honey, and the pounded root is applied as a paste to the body. Rheede says that the starch of the zedoary is much esteemed, and that the fresh root is considered to be cooling and diuretic, it checks leucorrhœal and gonorrhœal discharges and purifies the blood. The juice of the leaves is given in dropsy. One of us has had the plant in cultivation for some years; it blossoms in the hot weather just before the rains, when the first leaves begin to appear.

Description.—Guibourt's description already given agrees exactly with the Kachúra of India, but it is often cut into transverse slices instead of into halves and quarters.

Microscopic structure.—This is essentially the same as that of turmeric, but the resin and essential oil in the cells is of a yellowish-white colour, and the greater portion of the starch grains are ovoid or pyriform, instead of narrow and elongated as in turmeric.

Chemical composition.—Zedoary contains, according to Bucholz (*Repert. Pharm. xx.*, 376), volatile oil, a bitter soft resin, a bitter extractive matter, gum, starch, &c. The oil is turbid, yellowish-white and viscid, has a camphoraceous taste and smell, and consists of two oils, one lighter, the other heavier than water. Trommsdorff obtained from the root a substance which he called *Zedoarin*, but did not further describe it. A proximate analysis afforded:—

Essential oil, resin, curcumin, &c.	3·79
Resins, sugar	·90
Gum and organic acids	15·22
Starch	17·20

Crude fibre	10·92
Ash	6·06
Moisture	10·31
Albuminoids, Arabins, &c.	35·60
	100·00

Commerce.—The Bombay market is supplied from Ceylon. Value, Rs. 20 to Rs. 30 per candy of 7 cwts. The drug is chiefly used in India as a cosmetic. Roxburgh states that Bengal is supplied from Chittagong.

CURCUMA CÆSIA, *Roxb.*

Hab.—Bengal. Often cultivated. The tubers.

Vernacular.—Nar-kachúra, Káli-haldi (*Hind.*, *Guz.*), Káli-halad (*Mar.*), Káli-halad, Nilkanth (*Beng.*), Mána-pasupu (*Tel.*).

History, Uses, &c.—This drug is one of the two Zerumbáds of modern Persian writers on Materia Medica. Strange to say, it is not noticed by most European writers on Indian drugs, though it is well known and to be found in all the shops. It is the *Tommon itam* of Rumphius, and the *Curcuma long.* of Guibourt, who classes it with the turmerics. See *Hist. Nat.*, II., p. 210, 6me Ed., where a figure will be found. Guibourt's description is as follows:—" Ce curcuma est en tubercules cylindriques, c'est-à-dire qu'il conserve sensiblement le même diamètre dans toute sa longueur, malgré ses différentes sinuosités. Il est plus long que le précédent, mais beaucoup plus mince, n'étant jamais gros comme le petit doigt; sa surface est grise, souvent un peu verdâtre, rarement jaune, chagrinée, ou plus souvent nette et unie. Il est à l'intérieur d'une couleur si foncée qu'il en parait rouge-brun, ou même noir. Il a une odeur aromatique très dévelopée, analogue à celle du gingembre; sa saveur est également très aromatique et cependant assez douce et nullement amère. Il est impossible de méconnaitre dans cette racine les articles digités du *Curcuma domestica minor*. Enfin, on trouve dans le curcuma du commerce, mais en petit quantité, des tubercules

ronds de la grosseur d'une aveline, souvent didymes, ou offrat les restes de deux stipes foliacés. Ces tubercules offrent d'ailleurs tous les caractères des précédents, et sont les *matrices radicis* du *Curcuma domestica minor*." Nar-kachùra appears to have been once imported into Liverpool under the name on *Kutchoo*. (*Phar. Jour.* (II.), Vol. I., p. 17.) Aitchison (*Notes on Prod. of W. Afghanistan and N. E. Persia*, p. 51) remarks:—"Zedoary, *jidwár*, *jizwar*, *kachur*, *kachul*, is imported in quantity from India, most of it to be passed on to Turkistan. The long tubers are called *nar-kachul*, and the round ones *mada-kachul*, as if they were the products of two different plants, but I have only seen them mixed together, and not sold as two distinct roots. The Turkomans employ these roots as a rubefacient, to rub their bodies down with after taking a Turkish bath. In this part of the country, in lieu of these, the nodes on the roots of *Eremostachys labiosa* and another species are collected and sent on to Turkistan. Curcuma roots are employed a little in native medicine, and as a condiment."

The plant is a native of Bengal, and is cultivated there to supply the Indian market. Nar-kachúra is considered to have nearly the same medicinal properties as Kachúra; it is chiefly used as a cosmetic. The author of the *Makhzan* describes it as a kind of Zerumbád. (See *Makhzan*, article "Zerumbád.") Through the kindness of Surgeon-Major Peters we have been supplied with living tubers of this Curcuma from Dinapore; he informs us that it is common in gardens in Bengal, and is used as a domestic remedy in the fresh state much as turmeric is in this part of India. The fresh tubers are of a pale yellow colour, but after boiling and drying we find that they assume the *couleur foncée* of the drug found in the shops.

Description and Microscopic structure.—The minute structure of this tuber hardly differs from that of the zedoary. The starch contained in the cells of the parenchyme has been altered by heat, and appears as a finely granular mass nearly filling the cell. The resin cells are about as numerous as in the zedoary, but the contents are of a dusky orange colour. The vascular system consists of scalariform and spiral

vessels. As to the drug, it consists of small nearly globular central tubers, from which spring numerous lateral rhizomes about the size of ginger. It is of a dark-grey colour externally and marked with circular rings. Internally it is very hard and horny, of a greyish black, but when cut in thin slices of a greyish-orange. The odour and taste are camphoraceous.

Chemical composition.—A proximate analysis of this curcuma afforded:—

Essential oil, resin, &c.	4·47
Resins, sugar, &c.	1·21
Gum, organic acids, &c.	10·10
Starch	18·75
Crude fibre	25·20
Ash	7·57
Moisture	9·76
Albuminoids, &c.	22·94
	100·00

Commerce.—The drug comes overland from Bengal. Value, Rs. 4 to Rs. 5 per maund of 41 lbs. Guibourt appears to have become acquainted with it from its admixture with the turmeric of commerce.

Curcuma Amada,—*Roxb., Rosc. Scit. t.* 99, a native of Bengal, is the Am-haldi or Am-ada (mango ginger) of the natives of India. The lateral tubers, which are of the size and shape of ginger, and of a pale yellow colour, have an agreeable odour like the rind of the mango fruit. They are much used in Bengal as an ingredient in *chutneys,* and are considered to be carminative, stomachic, and cooling. In their medicinal properties they resemble ginger. The plant is hardly known in Western India, and is not the Amba-halad or mango turmeric of Bombay, which is *Curcuma aromatica.*

INDIAN ARROWROOT.

Indian or **Curcuma Arrowroot** is obtained from the following plants:—

Curcuma angustifolia, Roxb., a native of the tropical Himalaya and Oudh.

Curcuma leucorhiza, Roxb., a native of Behar. (*Rosc, Scit.*, *t.* 102.)

Curcuma montana, Rosc., a native of the Concan and Circars. (*Roxb. Cor. Pl.*, *t.* 151.)

Curcuma longa, Linn. The Turmeric plant. (*Bentl. & Trim.*, *t.* 269.)

Curcuma aromatica, Salisb., a native of the plains of India. (*Rosc. Scit.*, t. 103.)

Curcuma rubescens, Roxb., a native of Bengal.

Hitchenia caulina, Baker, a native of the Concan. (*Journ. Bomb. Nat. Hist. Soc.*, II., 140.)

Vernacular.—Tikhur (*Hind.*, *Beng.*), Tavakhir (*Mar.*).

History, Uses, &c.—Tavakshiri, and Tavakshiryeka-pattrika are Sanskrit names for certain species of Curcuma, from which are derived the vernacular terms *Tavakhir* and *Tikhur*, now in common use for Curcuma starch. The starch is prepared in many parts of India by grating or pounding the tubers, mixing the pulp thus obtained with water, straining it through a cloth, and allowing the liquid to stand until the starch separates. This, after several washings in water, is dried in the sun, and after powdering is ready for use.

The following account of the experimental cultivation of *C. angustifolia* and of the preparation of its starch at the Saidapet Experimental Farm, Madras, gives the most exact information we possess regarding the yield and cost of Curcuma Arrowroot:—"A flat measuring 0·25 acre was planted with this crop at the end of 1879, and remained down during the year under report. It was taken up at the end of January 1881 and yielded 986 lbs. of tubers, or at the rate of 3,944 lbs. per acre. The yield of flour obtained has generally been about 12½ lbs. from 100 lbs. of tubers, so that the above yield would represent an outturn of 493 lbs. of flour per acre. In another case in the College Experimental Garden, a plot measuring 1,160 square yards, planted with this crop yielded 1,793 lbs., or at the rate of 7,500 lbs. per acre. The culture of the plant is very simple: it is only necessary to plant the sets in properly prepared soil,

and to water them occasionally during the dry season. The removal of the crop is tedious unless the tubers can be ploughed out, as potatoes are in England, which is seldom possible, owing to the dryness of the soil. The flour can be sold profitably at four annas per pound, and at this rate Rs. 400 per acre could be realized."

Mr. Hamilton, F.C.S., to whom samples of the starch were submitted, reported that the mucilage yielded by a sample marked "1st sort" was nearly as good as that of Maranta arrowroot, but that the sample when soaked in cold water gave indications of the presence of slight acidity, and also contained a small proportion of soluble starch. He suggested the avoidance of unnecessary exposure to the sun, and the addition of ½ an ounce per gallon of caustic soda to the water used in steeping the pulped roots. All the samples sent to him contained extraneous matters, black particles, straw, &c., introduced during the process of drying, which, it is hardly necessary to say, would render the article unsaleable in Europe.

Curcuma arrowroot is inferior in colour to Maranta arrowroot; under the microscope it may differ greatly in appearance, as the starch grains of different species of Curcuma are variable in size and shape.

Commerce.—Madras in 1869-70 exported 3,729 cwts. of Curcuma arrowroot, valued at Rs. 14,152. In Bombay "Malabar Arrowroot" fetches from Rs. 3 to Rs. 4 per maund of 28 lbs.

CURCUMA LONGA, *Linn.*

Fig.—*Bentl. and Trim., t.* 269; *Rheede, Hort. Mal. xi., t.* 11. Turmeric (*Eng.*), Curcuma, Souchet des Indes, Safran des Indes (*Fr.*).

Hab.— Parasnathin Behar. Cultivated elsewhere. The tubers.

Vernacular.—Haldi, Haldar, Halja (*Hind.*), Halad (*Beng., Mar., Guz.*), Manjal (*Tam.*), Pasapu (*Tel.*), Mannal, Marinalu (*Mal.*), Arishina (*Can.*).

History, Uses, &c.—Turmeric appears to have come into use in India as a substitute for saffron and other yellow dyes, which were used by the ancient Arians before they invaded the country. The Arians were, as we know, great worshippers of the solar system, hence they held in special estimation those plants which yield a golden-yellow dye resembling sunlight, and attributed to them protective and auspicious properties.

Turmeric, best known as Haridra in Sanskrit, has forty-six synonyms, such as Pita "yellow," Gauri "brilliant," Varnavat "having colour," Kamala "lustful," Nisa, Rajani, and all other words which signify "night." The use of the latter synonyms is variously explained. A distinguished professor of Sanskrit, whom we consulted, referred us to one of the best commentators on the *Amarakośa*, who states that turmeric being a substance used for dyeing came to be called *rajani*, which etymologically means the material by which a thing is dyed, because the word *rajani* had already come to be used in the language to denote "night." A well-known Bombay *Vaid*, to whom we put the question, replied, "We have tradition that it is called 'night,' because in former times married women used daily to apply turmeric in the evening." On further enquiry we learned that this practice is not extinct, as he supposed, but still prevails in Goan villages, about Asnora, and probably elsewhere. Married women in the evening, when the house-work is completed, dip their hands in turmeric water and pass them lightly over their cheeks: the mistress of the house also performs the same office for any married friend who may happen to drop in at this time, and on some pretence detains her until the lamps are lighted. The reason they give for doing this is that the goddess Lakshmi may visit the house at this time. This goddess is regarded as the wife of Surya, and the practice is probably a survival of sun-worship. In Hindu ceremonial turmeric is almost always necessary. Amongst the most important occasions on which it is used we may mention the following as prevailing in most parts of India:—

A few days before the marriage ceremonies commence, five married women, or five virgins, anoint the bride with turmeric

and oil upon the forehead, head, breast, back, and feet, and the bride puts on a robe dyed with turmeric, which she wears until the day of the marriage. Turmeric and oil is sent from the house of the bride to the bridegroom, who is anointed in a similar manner, and sends back a similar present to the bride.

The marriage contract is stained or spotted with turmeric. During the ceremonies the sisters of the bridegroom perform *árta* before him with a dish of turmeric water, and, dipping their fingers in it, touch his forehead.

A portion of the wall is daubed with turmeric and dashes of *kunku* after the arrival of the bride in the bridegroom's house, and before it are placed the *kul* and all the clothes and ornaments constituting the marriage presents; the bridegroom, and after him the bride, prostrate themselves before this spot.

The bridegroom ties a thread round the bride's wrist, to which is attached a piece of turmeric and a betelnut.

Towards the end of the ceremonies the bridal party play with turmeric water, dashing it over one another.

A woman who performs *sati* and married women when they die are taken to the funeral pile clothed in a robe dyed with turmeric.

At all times when *púja*, or worship of the gods, is made, turmeric is necessary.

When a new *sári* (robe) has been purchased, two threads are drawn out, one of which is offered to Surya, and the other to the goddess Tulasi, and turmeric is applied to the corner of the cloth.

Turmeric powder and *kunku* (a pigment made with turmeric and lime) is presented to women who have husbands living, and to temple dancing girls, in the month of Chaitra, or upon the occasion of the Nauratra.

The Akshata rice used in various ceremonies is coloured with turmeric and lime.

In the *Ramayan* turmeric is mentioned as one of the eight ingredients of the *Arghya*, a respectful oblation made to gods

and venerable men. The following are the lines as given in the Hindi version of that poem:—

Dahi, dúrba, rochan, phal, múla,
Nav tulsi dal, mangal-mula.

Curdled milk, Durva grass,
Yellow gall stones of the cow, Fruit,
Roots, Lotus and Tulsi leaves,
Turmeric.

Medicinally turmeric is described in the Nighantás as hot, bitter, pungent, astringent and drying; it corroborates the humors, prevents skin diseases, is a useful application to swellings, boils, &c., and is given in jaundice. As a domestic remedy it is in daily use; rubbed down with oil it is applied to any roughness of the skin, with lime to bruises, sprains, and all kinds of wounds; a decoction forms a cooling eyewash, boiled with milk and sugar it is the popular remedy for a cold, the fumes are inhaled by those suffering from severe coryza, cloth dyed with turmeric is used as an eye-shade, and *ghi* mixed with powdered turmeric is given to relieve cough. As a spice the powder is an ingredient in curries and sweetmeats, and is used by every native of India. The leaves are also used as a condiment, especially with fish, which is wrapped in them and fried.

It is doubtful whether turmeric was known to the Greeks. Dioscorides mentions an Indian root as a kind of κύπειρος resembling ginger, but having, when chewed, a yellow colour and bitter taste. The Mahometans use turmeric medicinally in the same manner as the Hindus; they also prescribe it in affections of the liver and jaundice on account of its yellow colour. There are many Arabic names; the best known are Urúk-es-sufr "gold root," and Uruk-es-sabághín "dyers' root." The modern Persian name is Zard-chubah "stick saffron." The editor of the *Pharmacopœia of India* speaks favourably of the use of a decoction of turmeric in purulent conjunctivitis; he says it is very effectual in relieving the pain. In coryza he states that the fumes of burning turmeric directed into the nostrils cause a

copious mucous discharge, and relieve the congestion. (*Op. cit.* p. 231.)

Cultivation.—Turmeric requires a loamy soil and abundance of manure and water; the ground must be well worked and raised into ridges, 9 or 10 inches high and 18 to 20 broad, with intervening trenches 9 to 10 inches broad. The sets, which consist of small portions of the root, are planted on the tops of the ridges, at about 18 inches to 2 feet apart. One acre requires about 900 such sets, and yields about 2,000 lbs. of the fresh root (*Roxb.*). Other authorities state the yield at from 1,000 to 2,000 lbs. Dalzell and Gibson give very much higher figures for the best garden soil in Guzerat, *viz.*, 5,000 to 20,000 lbs. per acre. They state that the return to the cultivator is equal to that obtained from sugar-cane, *viz.*, Rs. 300 per acre. The time for planting is usually about the end of May, but it depends greatly upon the setting in of the rainy season. The crop may be raised in the following March or April; if left in the ground new shoots appear upon setting in of the following rains and the crop is lifted about 20 to 21 months after planting. In some parts of India it is not considered good practice to lift the plants the first year. When lifted, the roots have to be scalded in boiling water or by steaming them in their own juice, and to be dried in the sun or in an oven. Turmeric being much cultivated along with other crops it is impossible to obtain any reliable acreage returns.

Description.—The rhizome of the turmeric plant, like that of most Curcumas, consists of a central ovoid portion and several lateral elongated portions, all of a deep orange colour, from these proceed a number of radicles, at the ends of some of which colourless oval tubers are produced. The central and lateral rhizomes form the round and long turmeric of commerce. The former vary a good deal in size and shape; they may be pyriform, ovoid, or almost round, and are generally cut up into two or more pieces; the latter are cylindrical, tapering towards the extremities, and often more or less bent; both are marked by transverse furrows, and bear remains of the rootlets and

leaf-buds. Turmeric is of a deep brownish-yellow colour, of firm resinous consistence, and has a peculiar aromatic odour.

Microscopic structure.—Sections of the fresh rhizome show the exterior to be composed of several layers of compressed brown cells. The parenchyme consists of delicate polygonal cells of a yellow colour, the majority contain starch grains which are mostly elongated, but some are pyriform or ovoid; a smaller number of cells contain globular masses of yellow resinous matter, and a rich orange-yellow essential oil; those cells which contain much resin have little or no oil, when the resin is in small quantity there is much oil. The vascular system consists of scalariform and spiral vessels, which are most abundant near the boundary line which separates the cortical from the central portion of the rhizome. This boundary line is composed of small empty cells, having thicker walls than those of the rest of the parenchyme.

Chemical composition.—Turmeric contains about 1 per cent. of an essential oil. *Curcumin*, the yellow-colouring matter of turmeric, has been examined by several chemists, whose experiments have led to the conclusion that its formula is either $C^{10}H^{10}O^{3}$ or $C^{16}H^{16}O^{4}$ that it melts at 172°, forms red-brown salts with alkalies, is converted by boric or sulphuric acid into *rosocyanine*, by reduction with zinc-dust into an oily body, by oxidation into oxalic or terephthalic acid, and by fusion with potash into protocatechuic acid. The experiments of Jackson and Menke have, however, led to results differing in many respect from those above detailed, which were probably obtained from impure preparations.

The Curcumin used in their experiments was prepared by treating ground turmeric root (Bengal or Madras) with light petroleum to remove turmeric oil, and then with ether, which dissolves the curcumin together with a large quantity of resin; and it was finally purified by crystallization from alcohol. The quantity of curcumin thus obtained was only 0·3 per cent. of the root; the total quantity contained in the root is, however, much larger, as a considerable amount remains mixed with the

resinous impurities, and some also in the oil. Curcumin thus prepared crystallizes from alcohol in stout needles, appearing on microscopic examination to be made up of well-formed prisms with square ends, or in spindle-shaped crystals often arranged in radiate groups. It has an orange to yellow colour, according to the size of the crystals, with a beautiful blue reflex; its solution in ether exhibits a strong green fluorescence. It is inodorous when pure; melts at 178°, apparently with decomposition. It is nearly insoluble in water, somewhat soluble in cold, more readily in hot ethyl and methyl alcohols, more soluble in glacial acetic acid, less in ether, very slightly in benzene and carbon bisulphide, and all but insoluble in light petroleum. Strong sulphuric acid dissolves it with a fine reddish purple colour, gradually changing to black from charring; curcumin dissolves readily in alkalies and alkaline carbonates. Its ammoniacal solution gives off ammonia when boiled, and deposits unaltered curcumin. Baryta water converts it into a blackish-red powder, but lime water gives a red solution like that obtained with calcium carbonate. Curcumin is not affected by acid sodium sulphite. Pure curcumin gives, as the mean of several analyses, 68·30 per cent. carbon and 5·63 hydrogen, leading to the formula $C^{14}H^{14}O^{4}$, which requires 68·29 carbon, 5·69 hydrogen, and 26·02 oxygen, and this formula has been confirmed by the analysis of several derivatives. For an account of the derivatives of curcumin, confer. *Phar. Journ.*, Dec. 30th, 1882.

Turmeric oil or *Turmerol*, to which turmeric (and therefore curry powder) owes its aromatic taste and smell, has been extracted from Bengal turmeric by C. L. Jackson and A. E. Menke with light petroleum, and after being freed from the higher-boiling portion of that solvent by heating to 150° in a flask, it formed a thickish oily yellow liquid having a pleasant aromatic odour. It was purified by fractional distillation under diminished pressure, and was thereby separated into three portions, the first boiling below 193°, the second at 193° to 198°, and the third consisting of a viscous semi-solid residue. The middle portion consisted of nearly pure turmerol; the first of that substance contaminated with hydrocarbons from the

petroleum. The middle fraction, after further purification by distillation in a vacuum, gave, as a mean result of several analyses, 83·62 per cent. carbon and 10·42 hydrogen, agreeing nearly with the formula $C^{19} H^{29} O$, which requires 83·81 C. and 10·29 H. Turmerol is a pale yellow oil having a pleasant aromatic smell, and a density of 0·9016 at 17°. It is optically dextrogyrate, [a]=33·52. Under ordinary pressure it boils at 285° to 290°, but decomposes at the same time, yielding a substance of lower boiling point. (*Amer. Chem. Journ.*, IV., pp. 368-374.) Schimmel and Co. (*Bericht, Oct.* 1890) state that during a scientific investigation of Curcuma oil they proved it to contain *Phellandrene.*

Commerce.—The bulk of the turmeric cultivated in India is consumed in the East as a dye and condiment, and the consumption must be very large as every one uses it. Full particulars cannot be learned, but a trans-frontier trade exists, and the various Indian ports exchanged in 1886-87, 281,117 cwts., valued at Rs. 24,38,260. During 5 years from 1884 to 1888 Tuticorin exported 6,802 cwts. of turmeric at the average valuation of Rs. 7-8 per cwt. In the foreign trade turmeric is treated as a dye, and the statistics include the wild or Cochin kind. In 1885-86 the exports were 156,287 cwts., valued at Rs. 14,00,000; in 1886-87, 140,994, cwts. were exported, valued at Rs. 10,32,025. The trade fluctuates greatly: in 1881-82 only 70,783 cwts. were exported; in 1876-77, 123,824 cwts.

KÆMPFERIA GALANGA, *Linn.*

Fig.—*Rosc. Scit., t.* 92; *Wight Ic., t.* 899; *Rheede, Hort. Mal. xi., t.* 41.

Hab.—In the plains throughout British India. The tubers.

Vernacular.—Chandra-múla (*Hind.*), Chandú-múla, Húmúla (*Beng.*), Kachula-kalangu (*Mal., Tam.*), Chandra-múla, Utuen (*Mar.*), Kapúr-kachri (*Guz.*).

History, Uses, &c.—The plant is called Chandra-múla or Chandra-mulika in Sanskrit, but it is not mentioned in the

Raja-nirghanta. It is much cultivated in gardens by the Hindus, whose women use the aromatic leaves and roots as a perfume when washing their hair; on this account the vernacular names *Utnen* and *Kapur-kachri* have been given to it in Western India, as its odour exactly resembles that of the root of *Hedychium spicatum,* which is sold in the bazars as a *Kapur-kachri,* and is an ingredient in the *Utnen* or perfumed powder for the hair, which has been described in Vol. ii., p. 234. Rheede states that the tubers reduced to powder and mixed with honey are given in coughs and pectoral affections, boiled in oil they are applied externally to remove obstructions in the nasal passages. In the *Dict. Econ. Prod. of India* (IV, 561), it is stated on the authority of Mason that the roots are often seen attached to the necklaces of Karen women, for the sake of their perfume, and that they also place them in their clothes for the same reason. They are also said to be used as a masticatory along with betel leaves and areca nut.

Description.—The roots consist of branched tubers, resembling ginger in form, which give off fleshy fibres bearing white pendulous tubers; they have a peculiarly agreeable camphoraceous odour, exactly like that of the Kapur-kachri of the bazars. The leaves are radical, petioled, ovate-cordate, between acute and obtuse; margins membranaceous and waved; upper surface smooth, deep green; under surface pale and somewhat woolly. The leaves are much crowded, but when they can find room they spread flat on the surface of the earth, the petioles are hid beneath the soil and form cylindric sheaths enclosing the fascicles of flowers, which are of a pellucid white, or white marked with purple spots, and have the same fragrant odour as the leaves and roots. All parts of the plant have a bitterish and camphoraceous taste.

The roots are not met with in commerce, but, judging from some which we have sliced and dried, would appear to be capable of supplying an article equal to the *Kapur-kachri* of the shops. (See *Hedychium spicatum).* The plant is cultivated with the greatest ease, and yields a large crop of roots.

Chemical composition.—The fatty matters dissolved out of this tuber by ether consisted of a fragrant liquid oil, and a solid white crystalline substance separated by petroleum ether. The alcoholic extract, amounting to 2·76 per cent., contained some white transparent prisms of an alkaline nitrate, and a few nodules of a circular-shaped crystals of a yellowish colour. This extract contained a small quantity or alkaloid, and some sweet body reducing Fehling's solution. A large quantity of starch is present, and 4·14 per cent. of gum. The tubers dried at 100°C lost 4·11 per cent. of moisture, and yielded 13·73 per cent. of mineral matter.

KÆMPFERIA ROTUNDA, *Linn.*

Fig.—*Rosc. Scit., t.* 97; *Bot. Mag., t.* 920 and 6054; *Wight Ic., t.* 2029; *Rheede, Hort. Mal.* xi., *t.* 9.

Hab.—Throughout India, often cultivated.

Vernacular.—Bhume-champa (*Hind.*), Bhin-champa (*Beng.*), Bhin-champo (*Guz.*), Bhin-chapha (*Mar.*), Konda-kalava (*Tel.*), Malan-kua (*Mal.*)

History, Uses, &c.—This plant, called in Sanskrit Bhumi-champaka, "ground champaka," from the sweetness of its flowers resembling that of the champaka (*Michelia*), though not mentioned in the Raja-nirghanta, is one of the commonest domestic remedies of the Hindus. Its small globular pendulous tubers, at one time supposed to be the "round zedoary" of the druggists, are used throughout India as a local application to tumours, wounds, and swellings of all kinds. Rheede states that in Malabar the whole plant, when reduced to powder, and used in the form of an ointment, is considered to be of wonderful efficacy in healing fresh wounds, and that, taken internally, it is thought to remove any coagulated blood or purulent matter that may be within the body; he adds that the root is a useful application to anasarcous swellings. In Western India the tubers are used as a popular local application in mumps* (*Gal-*

* Tuberous roots were used by the ancients for the same purpose. Cf. Scrib. Larg. Comp. 44.

gand), but as they are generally combined with more active remedies, such as Croton seeds, Aconite, and Nux Vomica, it is probable that they do not contribute much to the cure. The root consists of several central, almost globular rhizomes, from which proceed numerous, thick, fleshy rootlets, all of which terminate in small, oblong, or round tubers; the substance of the rhizomes and tubers is of a pale straw colour, and has a bitter, pungent, camphoraceous taste, much like that of true zedoary; the whole plant is aromatic.

HEDYCHIUM SPICATUM, *Ham.*

Fig.—*Bot. Mag.*, *t.* 2300.

Hab.—China Himalaya. The tubers.

Vernacular.—Kápúr-kachri, Kachúr-kacha, Kachri (*Hind.*), Kápúr-kachari (*Mar.*, *Guz.*), Shimai-kichilik-kizhangu (*Tam.*).

History, Uses, &c.—Sati, the Sanskrit name for *Curcuma Zedoaria*, is sometimes erroneously applied to this plant, which is not mentioned in the *Raja Nirghanta.* In the Himalayas it is known as *Sheduri*, and the leaves are made into mats which are used as sleeping mats by the hill people. The aromatic root-stocks are used as a perfume along with Henna (*Lawsonia alba*) in preparing the cloth known in the North-West Provinces as Malagiri (*Watt*). The sliced and dried root is an article of considerable importance in Indian trade, as it is a principal ingredient in the three kinds of *Abîr*, or scented powder, used by the Hindus in worship, and as a perfume. White Abír is made from the following ingredients:—The root of *Andropogon muricatus*, the tubers of *Hedychium spicatum*, sandalwood and arrowroot (Indian), or flour of Sorghum. The kind of Abír called *Ghísí* in Hindí, and *Padí* in Guzeráthí, contains in addition to the above ingredients the seeds of *Prunus Mahalib*, *Artemisia Sieversiana*, the wood of *Cedrus Deodara*, the tuber of *Curcuma Zedoaria*, cloves and cardamoms. Black Abír, or *Bukka* of the Deccan, contains in addition to all the above ingredients, Aloeswood, costus, the root of *Nardostachys Jatamansi*, and liquid Storax. The scented powder of the Jains called *Vásakhepa* or

Vásakshepa, does not contain it, but consists of sandalwood, saffron, musk, and Borneo camphor. Two kinds of Kápúr-kachrí are found in the Bombay market, *viz.*, Chinese and Indian ; the latter was supposed by Royle to be the *Sittarittee* or lesser Galangal of Ainslie (*Mat. Ind.* I., p. 140), but Moidín Sheriff states that the Sittarittee of the Tamils is the true lesser Galangal, which statement appears to be correct. Powell informs us that the rhizome is pounded with tobacco and smoked in the Punjab.

Description.—Indian Kápúr-kachrí occurs in slices, mostly circular, but sometimes the section is made in a sloping direction ; the slices are ½ an inch or less in diameter, and vary much in thickness ; they are white and starchy, and when freshly pared exhibit a faint line dividing the cortical from the central portion ; the edges of each slice are covered by a rough reddish-brown bark marked with numerous scars and circular rings ; here and there rootlets remain attached ; the odour is like that of orris root, but more powerful and strongly camphoraceous ; the taste pungent, bitter, and aromatic. The Chinese drug is a little larger than the Indian, whiter, and less pungent; the bark is smoother and of a lighter colour.

Microscopic structure.—The rhizome consists of a delicate parenchyma, most of the cells of which are loaded with large ovoid starch grains, a few contain a yellowish resin, and essential oil ; the epidermis is composed of several rows of compressed, nearly empty, reddish-brown cells. From the unaltered condition of the starch it appears that the rhizomes are not exposed to heat.

Chemical composition.—The dried tubers have been examined by J. C. Thresh (*Pharm. Journ.* [3] XV, 361). The proximate analysis gave the following results:—

Soluble in petroleum ether—		
Ethylmethylparacoumarate..............	3·0	5·9
Fixed oil and odorous body..............	2·9	
Soluble in alcohol—		
Indif. substance ppt. by tannin..............		2·7
Acid resin, &c.		

Soluble in water—

Glucoside or saccharine matter	1·0
Mucilage	2·8
Albuminoids, organic acid, &c.	1·9
Starch	52·3
Moisture	13·6
Ash	4·6
Cellulose, &c.	15·2
	100·0

The odorous principle was entirely taken up by petroleum ether, upon allowing the petroleum ether to evaporate slowly, an abundant crop of large, colourless, tabular crystals was obtained, together with a pale yellowish-brown oily fluid. These crystals, after washing with cold petroleum, were submitted to a series of recrystallizations in order to remove traces of the odorous matter. They were finally obtained quite odourless, and found to possess the following properties:—Soluble in petroleum ether, ether, alcohol, chloroform and benzol. Insoluble in diluted solutions of potash, soda or ammonia. Sulphuric acid dissolved it in the cold without production of colour, but if heated the solution became purple red. The alcoholic solution was neutral in reaction, not coloured by ferric chloride or precipitated by basic lead acetate. It did not reduce silver salts.

The melting point (uncorrected) was found to be 120—121° F. (49° C.), and after melting it would remain fluid at ordinary temperatures for days if left undisturbed.

By burning with copper oxide in a current of oxygen the following results were obtained:—

·2931 gram yielded ·7490 gram CO^2 and ·1804 gram H^2O.

·2703 gram gave ·6912 gram CO^2 and ·1690 gram H^2O.

These results agree with the empirical formula $C^{12}H^{14}O^3$:—

The uncrystallizable portion of the petroleum ether residue was found to consist of the odorous principle, a fixed oil and a very considerable proportion of ethylmethylparacoumarate, the latter doubtless prevented from crystallizing by the presence

of the former. Upon saponification of the mixture with alcoholic potash, two crystalline acids were obtained, the *methyl-paracoumaric* and another, apparently a fatty acid. This latter was totally insoluble in boiling water, but crystallizable from alcohol. The quantity obtained did not enable the author to identify it with certainty. A minute quantity of the oily fluid abovementioned dropped upon the clothes, rendered them highly odorous for a considerable length of time, or, if exposed caused a large room to be pervaded with an odour resembling that of hyacinths.

Commerce.—The Chinese drug which forms by far the greater proportion of the commercial article is shipped to Indian ports *viâ* Singapore, and is valued at Rs. 4⅔ per maund of 37½ lbs. Sir E. Buck (*Dyes and Tans of the N.-W. Provinces*) gives the export from Kumaon in 1875-76 as 95⅙ cwts., and also states that in the same year an equal quantity was exported from Garhwal, and 40½ cwts. from the Bijnor district. In Davies' *Trade Report* 25 maunds (about 2,000 lbs.) are given as the annual export *viâ* Peshawar to Afghanistan (*Dict. Econ. Prod. Ind.* IV., p. 208). The Indian kind is valued in Bombay at about Rs. 5 per maund of 37½ lbs. It is not so handsome in appearance as the Chinese, but is more odorous.

ZINGIBER OFFICINALE, *Rosc.*

Fig.—*Bentl. and Trim.*, *t.* 270; *Rosc. Monand. Pl.*, 83; *Woodville*, *t.* 250; *Steph.* and *Ch.*, *t.* 96.

Hab.—Cultivated throughout the East. The rhizome.

Vernacular.—(Fresh) adrak, adi, (dry) Sonth (*Hind.*); (fresh) Alen, (dry) Sonth (*Mar.*); (fresh) Ada, (dry) Sont (*Beng.*); (fresh) Inji, (dry) Shukku (*Tam.*); (fresh) Allam, (dry) Sonti (*Tel.*); (fresh) Hasisunthi, (dry) Vana-sunthi (*Can.*); (fresh) Adu, (dry) Sunth (*Guz.*); (fresh) Inchi, (dry) chukka (*Mal.*).

History, Uses, &c.—Ginger has been cultivated in India from prehistoric times; it is a native of the East, but is not now known in a wild state. In Sanskrit it bears many

names, such as Mahaushadha "great remedy," Visva "pervader," Visva-bheshaja "panacea," Sringavera "antlered," Katubadra "the good acrid," &c. When dried it is known as Sunthi and Nágara in distinction from Ardraka "fresh ginger." In the Nighantás it is described as acrid and digestive, useful for the removal of cold humors, costiveness, nausea, asthma, cough, colic, palpitation of the heart, tympanitis, swellings, piles, &c. Ginger is one of the three acrids (trikatu) of the Hindu physicians, the other two being black pepper and long pepper; combined with other spices and sugar, as in the preparations known as *Samasarkara churna* and *Saubhagya sunthi*, it is given in dyspepsia and loss of appetite. In rheumatism preparations of ginger and other spices with butter are given internally, and it is an ingredient in oils used for external application. The juice of the fresh tubers, with or without the juice of garlic, mixed with honey, is a favourite domestic remedy for cough and asthma, with lime juice it is used in bilious dyspepsia, and a paste of dry ginger and warm water is applied to the forehead to relieve headache. In Western India, ginger juice, with a little honey and a pinch of burnt peacock's feathers, is the popular remedy for vomiting. In old Persian we find the names *Shingabir* or *Shangabir* and *Adrak* applied to ginger, and it was probably through the Persians that the Greeks first became acquainted with it, as their ζιγγίβερι is evidently derived from the Sanskrit *Sringavera* through the Persian form of the word. The Arabic name *Zanjabil* is of similar origin, the chief difference being the substitution of the letter J for G, which is not in the Arabian alphabet.

Ginger is described by Dioscorides as hot, digestive, gently laxative, stomachic and having all the properties of pepper; it was an ingredient in collyria and antidotes to poison. Pliny notices it in his chapter on peppers, but very briefly, and it does not appear to have been regarded as an article of much importance in his time.

In the second century of our era, ginger is mentioned as liable to duty (vectigal) at Alexandria along with other Indian spices.

(*Vincent Com. and Nav. of the Ancients*, III, 695). Galen recommends it in paralysis and all complaints arising from cold humors; Paulus in neuralgia and gout. Ibn Sina and other Arabian and Persian physicians closely follow the Greeks, but enlarge upon its aphrodisiacal properties. In modern medicine the value of ginger as a carminative in atonic dyspepsia and flatulent colic, and as a masticatory in relaxed conditions of the throat is generally admitted.

The manufacture of ginger beer and ginger ale forms a large portion of the mineral water trade in England; indeed, some makers have acquired a special reputation for their production. Besides the large number of fermented and aërated ginger beers consumed at home, a good deal of ginger ale is shipped in glass bottles from Belfast, especially to the United States. About 16,000 packages or casks are so exported annually, for it has become a fashionable beverage in America among all classes.

According to the American official returns the imports in the two years ending June were as follows (the duty being 20 per cent.):—

	1888.	1889.
	Dozen bottles.	Dozen bottles.
Ginger ale and beer......	231,721	261, 828
Ginger cordial..................		262
Preserved ginger (35 per cent. duty) value......	$14,289	$2,670
	Hundredweights.	Hundredweights.
Raw ginger (duty free)	34,194	27,718

The value of the ginger ale and beer imported there was in 1887, $153,376 ; in 1888, $126,987, and in 1889, $92,001. The manufacture of ginger ale seems to have been commenced there also; for last year 3,512 dozen quarts were sent away from New York and New Orleans, besides what was locally consumed.

The number of uses to which ginger is applied besides as a spice, confection and medicine are many ; for instance, we have gingerade, ginger ale, ginger beer, ginger brandy, ginger bread,

ginger champagne, ginger cordial, ginger essence, ginger lozenges and ginger wine.

On the Continent of Europe, ginger is less used and appreciated than in England.

Soluble essences of ginger are required for making good ginger beer, and Belfast and American ginger ales. There are aërated and fermented ginger beers; the best unbleached Jamaica ginger, well bruised, being used for the latter. Ginger is also used for a kind of cordial and champagne.

Lastly, young ginger is candied and preserved to a considerable extent in the East, and comes into commerce under the section of "succades." The quantity imported into England from India and China ranges from 300,000 to 600,000 pounds, of the value of £11,000 to £25,000. The mode of preserving it is to steep the rhizomes in vats of water for several days, changing the water once. When taken out it is spread on tables and well pricked or pierced with bodkins. The rhizomes are then boiled in a copper caldron, then steeped for two days and nights in a vat with a mixture of water and rice flour. After this they are washed with a solution of lime, then boiled with an equal weight of sugar and a little white of egg is added to clarify.

After the ginger has been boiled a second time it is put in glazed jars of pottery, holding 1 pound, 3 pounds or 6 pounds, and covered with syrup. The syrup is changed two or three times, and then they are shipped in cases holding six jars.

The quality called " Mandarin " is put up in barrels. (*P. L. Simmonds, Amer. Jn. Pharm.* 1891.)

Description.—Many qualities of ginger are met with in Eastern commerce, which vary greatly in appearance ; the fresh tubers also vary in size, flavour and colour in different soils. One variety found in gardens in the Concan has a darker colour than ordinary ginger and somewhat of a zedoary flavour ; it is known as *Kala-Ala,* " black ginger." Dried ginger is known in two forms, namely, the rhizome with its epidermis, in which

case it is called *coated*; or deprived of epidermis, and then termed *scraped* or uncoated. The pieces, which are called by the spice dealers *races* or *hands*, rarely exceed 4 inches in length and have a somewhat palmate form, being made up of a series of short, laterally compressed, lobe-like shoots or knobs. Uncoated Cochin ginger, which is the best kind produced in India, has a pale buff hue, and a striated, somewhat fibrous, surface. It breaks easily, exhibiting a short and farinaceous fracture with numerous bristle-like fibres and closely resembles Jamaica ginger in appearance and flavour. "Black" Cochin ginger is that dried in the wet weather by means of hot ashes. Bengal and Bombay gingers have a brownish or reddish external surface, and the fractured surface is harder and darker, the flavour is less delicate than that of the Cochin sort. Coated gingers are now seldom met with, but Indian commercial samples usually contain a proportion of shrivelled and imperfectly scraped roots.

Chemical composition.—Ginger has been very completely examined by J. C. Thresh. (*Pharm. Journ.* (3) xii., 721). He found Cochin ginger to contain volatile oil 1·350 ; fat, wax (?) and resin (in the petroleum ether solution), 1·205; neutral resin ·950; *a.* and *b.* resins, ·865; *Gingerol*, ·600; substance precipitated by acids, 5·350; mucilage, 1·450; indifferent substance precipitated by tannin, organic acids, &c., 6·800; extractive soluble in alcohol not in ether or water, ·280; alkaloid a trace; metarabin, 8·120; starch, 15·790; pararabin, 14·400; oxalic acid (as CaC^2O^4), ·427; cellulose, 3·750; albuminoids, 5·570; vasculose, &c., 14·763; moisture, 13·530; ash, 4·800. The essential oil is pale-yellow, lævogyre and not acrid. Gingerol, the active principle, is a straw-coloured, viscid, odourless fluid of extremely pungent taste.

According to S. J. Riegel, East India ginger yields 8 per cent. of oleo-resin, whereas Jamaica ginger only yields 5 per cent. It may be best extracted by alcohol, ether or chloroform, benzin will dissolve it, but it does not exhaust the drug as satisfactorily as the other solvents.

Commerce.—Ginger is extensively cultivated in British India, from the Himalayas to Cape Comorin.

In the Himalayas it is successfully reared at elevations of 4,000 or 5,000 feet, requiring, however, a moist soil. The Malabar ginger, exported from Calicut, is the produce of the district of Shernaad, situated to the south of Calicut. In the Dacca district the natives cleanse the roots in boiling lime water, which probably injures much of the fragrant pungency, whereas in Jamaica they use simply plain water.

In order to dry ginger into what is called "sonth" in India —that is, to enable it to keep—the fresh roots are put into a basket, which is suspended by a rope, and then two men, one on each side, pull it to and fro between them by a cord attached, and thus shake the roots in the basket; this process is carried on for two hours every day for three days. After this the roots are dried in the sun for eight days, and again shaken in the basket; the object of the shaking being to take off the outer scales and skin of the roots. Two days further drying completes the process, and the ginger sells at about a rupee, or two, for 6 or 8 pounds. The value of the East Indian ginger exported went on increasing from about £63,000 (44,457 hundredweights) in 1881 to over £199,000 (133,280 hundredweights) in 1887; but in the last three years it has retrograded, having fallen to £70,398 (61,774 hundredweights) in the financial year ending March, 1890.

Last year, of 63,500 cwts. imported into England, India sent 53,500 cwts., Jamaica, 5,900 cwts., and West Africa, 2,600 cwts. *(P. L. Simmonds.)*

ZINGIBER CASSUMUNAR, *Roxb.*

Fig.—*Roxb. in As. Research.* 11, *t.* 7; *Bot. Mag.*, *t.* 1426; *Rox. Monand. Pl.*

Hab.—India. The rhizomes.

Vernacular.--Ban-ada (*Beng.*), Nisa, Malabari-halad (*Mar.*), Karpushpu (*Tel.*), Ban-adrak, Ban-adi (*Hind.*).

History, Uses, &c.—This plant, in Sanskrit Vaárndraka or "wild ginger," though not mentioned in the Rája Nirghanta, appears to be well known in most parts of India as a domestic remedy among the peasantry, who rub down the tubers with water for administration in diarrhœa and colic. Though Roxburgh has named this plant *Cassumunar*, it appears to be very doubtful whether its roots have ever been exported to Europe or have ever been an article of commerce in India. *Kattu-mannal* is a Malabar name for the yellow zedoary, and it appears to be this plant which has furnished the Cassumunar root of the druggists (cf. *Pereira, Mat. Med.*, ii., Pt. 1, p. 236). In odour and taste both roots are very similar. The Marathi name Nisa is Sanskrit and signifies "turmeric," and seems to indicate that the tubers of this plant are used as a substitute for that article by the peasantry.

Description.— The fresh rhizomes are 1 to 2 inches in diameter, jointed, compressed, with numerous white fleshy radicles, to some of which white tubers are attached. Each joint of the rhizome is furnished with a leaf bud. The epidermis is scaly, light-brown, the interior of a rich golden yellow, the odour is powerful and not very pleasant, like a mixture of ginger, camphor, and turmeric; the taste hot and camphoraceous.

Microscopic structure.— The epidermis is formed of many layers of compressed and obliterated cells. The parenchyma consists of large polyhedral cells; those in the cortical portion of the rhizome are nearly free from starch, but those in the central portion are filled with large ovoid starch granules. In all parts of the rhizome large cells full of a golden-yellow essential oil abound. The vascular system resembles that of turmeric.

Chemical composition.—The drug yielded to analysis:—

Ether extract (essential oil, fat, and soft resins) ...	6·96
Alcoholic extract (sugar, resins)	7·29
Water extract (gum, acids, &c.)........................	13·42
Starch	15·08
Crude fibre	12·61
Ash	6·80
Moisture	7·66
Albuminoids, modifications of arabin, &c.	30·18
	100·00

The root had a pungent odour, similar to a mixture of camphor and nutmeg, the soft resin had a bitter and burning taste. The colouring matter had many of the reactions of curcumin, but was more readily bleached than true curcumin, and the colour of the powder was very fugitive. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid. The root contained more mucilage and sugar than that of *Curcuma aromatica.* We were unable to separate any of the "soapy extractive" mentioned in the analysis of Cassumunar root by Luca.

Costus speciosus, *Sm., Lam. Ill. i., t.* 3; *Rheede, Hort. Mal. xi., t.* 8.

Vernacular.—Keú (*Hind.* and *Beng.*), Peṅva पेंवा (*Mar.*), Kemuka (*Sans.*). Roxburgh notices a preserve made of the fresh roots which is considered wholesome and nutritious. *C. speciosus* is the *Tjana-kua* of Rheede and the *Herba spiralis hirsuta* of Rumphius. Ainslie, quoting Brown's History of Jamaica, says that the root is there used as a substitute for ginger, but is very inferior to it. (*Mat. Ind.* ii., 167.) In the *Calcutta Exhibition Catalogue,* the root is described as depurative and aphrodisiac; similar properties are attributed to it in the Concan, where it is very abundant in moist situations. The rhizome resembles the great Galangal in growth and structure, but has no aromatic properties, the taste being mucilaginous and feebly astringent; it could only be used as a substitute for ginger by being preserved with a quantity of that root sufficient to flavour it.

ELETTARIA CARDAMOMUM, *Maton.*

Fig.—*Rheede, Hort. Mal. xi., tt.* 4 and 5; *Bentl. and Trim., t.* 267; *Woodville, t.* 231; *Roxb. Cor. Pl. iii., t.* 226. Malabar Cardamom (*Eng.*), Cardamome du Malabar (*Fr.*).

Hab.—West and South India. The fruit.

Vernacular.—Chhoti-iláyachi or iláchi (*Hind.*), Elaich, Gujrati-elaich (*Beng.*), Elchi (*Guz.*), Veldoda (*Mar.*), Ella-kai (*Tam.*), Yálakki (*Can.*), Elettari (*Mal.*), Elakaya, Vittula (*Tel.*).

History, Uses, &c.—The small cardamom, in Sanskrit Ela, is mentioned by Susruta. In the Nighantas it bears various synonyms, such as Truti, Kapota-varni "grey," Korangi, and Dravidi "coming from the Dravidian country." The large or Nepal cardamom (*Amomum subulatum*) is called Sthulaila "large Ela," and is described separately. Both kinds are considered to be digestive, pungent, light and hot, and are recommended in phlegmatic affections, such as cough, asthma, piles, and diseases of the bladder and kidneys. These two cardamoms are described by Ibn Sina under the name of قاقله (kakulah); he also describes separately under the name of هيل بوا (hilbawa) another kind of cardamom as more easily digested than the *kakulah*. This latter cardamom is the true *Cardamomum majus* or *Nutmeg cardamom* of Africa to which Pereira has given the name of *Amomum korarima*. We think that there can be no doubt that the Greeks were acquainted with the cardamoms of India which they appear to have first obtained from the Persians through Syria and Armenia. Dioscorides says:—"Choose that which is tough, well filled, closed; if not in this state, it is too old and has lost its aroma. The taste is pungent and somewhat bitter." With respect to the name Kátídáús, the Greeks appear to have applied it to this spice in much the same way as the Persians applied the name kakulah, which originally meant the fruit of some other plant which was used for flavouring bread. In the *Burhán* it is stated that the name *kakulah* is also given by some to a fruit like *sapandan* (a kind of cress), which is the same as *Ilachi.*

Besides the two Indian cardamoms, there is a large kind of cardamom which comes from Ceylon, now found in commerce. Dr. Trimen, in his *Systematic Catalogue of the Flowering Plants and Ferns of Ceylon*, speaks of the plant which produces it as *Elettaria cardamomum*, Maton, *var. major*—the *Ensál* of the Singhalese.

As a masticatory and for flavouring food, the Malabar or small cardamom is preferred by the natives, but the other kinds, which are cheaper and of less delicate flavour, are largely used by the sweetmeat makers.

Cultivation.—There are two ways of propagating the plant, viz., by sets or by seed. The chief requirements for successful cultivation are a rich loamy soil, and a site sheltered from strong winds and too much direct sunlight. Clearings in forest land, with a few trees left here and there, in order to give the requisite shade and shelter, are found to offer the best conditions for the production of good crops. In the planting of sets, young ones of one to two years old should be chosen. Holes one foot deep and 18 inches wide are dug, and into these, after they have been prepared as beds, raised a few inches above the surrounding ground, the sets are inserted just below the surface of the soil.

The spaces between each plant may be from 6 to 12 feet, according to the quality of the soil. The ground should be well cleared of weeds, stones and rubbish, but when the plants have grown to a certain size, no further weeding will be necessary, as nothing will grow under their shade. Seeds should be sown in prepared nurseries, care being taken not to sow too deep. The seedlings, when 6 to 8 inches in height, should be transplanted and treated in the same manner as sets. (*Dict. Econ. Prod. Ind.* iii., p. 229). For the particulars of cardamom cultivation in the Wynaad, Travancore, Mysore, Madura, Coorg, and Canara, the same work may be consulted. To prepare cardamoms for the market, they are washed, bleached, and starched. For washing, 2 lbs. of pounded soapnuts and ¼ lb. of *Acacia concinna* pods are mixed with about

5 gallons of water, and a separate solution of common country soap is made. Three quarts of the soapnut mixture are added to 8 quarts of water, and in this 10 lbs. of cardamoms are well agitated by hand and then transferred to a basket to drain for a few minutes. They are then washed a second time in 7 quarts of water, one of the soapnut mixture, and one of the soap solution, drained and thrown upon a mat. Then they are continually sprinkled with fresh water by relays of women until sunrise next morning, when they are spread out on mats to dry for four or five hours. The stalks are then cut off with scissors, at which work some women are so expert as to be able to nip 90 cardamoms in one minute. This done, the cardamoms are sorted for export. The starching process, which has only lately been introduced, consists in sprinkling the cardamoms with a thin paste made of rice and wheat flour, country soap, and butter milk, and rubbing them between the palms of the hands.

The washing mixtures are used for two lots of cardamoms and are then thrown away. The women who wash are paid 3 annas per diem; the night watchers 4 annas, and the nippers 2½ annas per 13 lbs.

Description.—The cardamom of commerce is a dry, three-sided, oblong, or roundish capsule of a yellowish-brown or dirty white colour. The pericarp is tough, and divides into three valves, from the middle of the inner surface of each a partition projects towards the axis, so as to divide the capsule into three cells, each of which is filled with closely packed angular seeds, each surrounded by a thin transparent membrane (aril). The seeds are of a rich brown colour, about two lines long, transversely rugose, with a depressed hilum, and deeply channelled raphé. The capsule is almost tasteless. The seeds have a pungent, camphoraceous, agreeable flavour, and leave a sensation of cold upon the tongue when chewed.

Microscopic structure.—The testa of the seed is formed of three layers: 1*st*, a layer of thick-walled striated cells; 2*nd*, a layer of large thin-walled cells; 3*rd*, an internal layer of dark-brown radiating cells, with very thick walls. The albumen is

colourless and consists of polyhedral cells containing starch, and generally rhomboidal masses of albuminous matter, which can be easily seen when thin slices of the albumen in almond oil are examined by polarized light.

Chemical composition.—The parenchyme of the albumen and embryo is loaded with fatty oil and essential oil, the former existing in the seed to the extent of about 10 per cent. The essential oil, which amounts on an average to 4·6 per cent., has the odour and flavour of the seeds; it consists chiefly of a liquid having the formula $C^{10} H^{22} O^{3}$. According to Flückiger, the raw oil is dextrogyre, and deposits after a time a camphor, which he considers to be identical with common camphor, as it agrees with that substance in optical properties and crystalline form. The water which comes over when cardamoms are distilled, contains acetic acid. The ash of cardamoms, which, according to Warnecke, amounts to 6·12 per cent. in common with that of several other plants of the same order, is remarkably rich in manganese.

Commerce.—The trade in Indian cardamoms seems to have been declining for some years past. In 1880-81 the *exports* to foreign countries were valued at Rs. 8,20,257, but the returns for that year were the highest on record. For subsequent years they were as follows:—1883-84, Rs. 5,68,334; 1885-86, Rs. 5,60,012; and 1887-88, Rs. 2,04,858. In 1883-84, the United Kingdom received of the above, cardamoms to the value of Rs. 4,05,649, but last year only Rs. 52,658.

After the United Kingdom the other receiving countries are generally in the following order of importance:— Arabia, Germany, Persia. On the other hand, the *imports* of foreign cardamoms seem to be on the increase. In 1880-81 they were valued at Rs. 4,134, and taking the same years as have been given for the exports, the imports were in 1883-84, Rs. 18,351; 1885-86, Rs. 92,205; and 1887-88, Rs. 2,60,450.

During this year the bulk of the imports (*viz.*, Rs. 2,51,211 worth) came from Ceylon, and of the total of these foreign imports, Bombay received Rs. 2,16,455 worth. Of the internal

trade in cardamoms, full statistics are not available, but excluding the transfrontier trade by land, it was last year valued at Rs. 25,11,053.

In Travancore the cardamom cultivation and trade are a monopoly of the State. The drug is grown on the Cardamom Hills, and is brought down, under guard, to Alleppy to be exported. The following table gives a Statement of the sale of Travancore cardamoms during the last sixteen years:—

Statement of the Sale of Travancore Cardamoms, 1875 *to* 1891.

Year M. E.	Cardamoms in candies of 600 E. lbs.	Average price per candy in Rupees.	Total amount realized.
		Rs.	Rs.
1051	275	838	2,30,268
1052	47	1,600	74,692
1053	133	1,719	2,28,526
1054	140	2,353	3,28,176
1055	248	1,966	4,87,596
1056	188	1,833	3,44,320
1057	158	1,427	2,25,855
1058	62	1,825	1,13,397
1059	303	1,018	3,08,601
1060	484	769	3,72,278
1061	148	682	1,01,101
1062	88	863	75,892
1063	256	492	1,26,058
1064	176	776	1,36,018
1065	84	590	49,787
1066	326	534	1,74,847

This table includes all cardamoms sold. Some will be exported by sea and some sent by backwater to Cochin, so

what is sent to Cochin will also appear as exports from that Port.

The following notes have been kindly furnished by Mr. T. F. Bourdillon, Conservator of Forests, Travancore, late Superintendent of the Cardamom Hills:—

The cardamom plant is indigenous in the evergreen forest of Travancore, between the elevations of 400 and 4,000 feet, but thrives best at the higher of these altitudes.

The spice is divided into 3 classes: (1) *Magara ēlam*, or those cardamoms which ripen in the month of Magaram (January); (2) *Kanni ēlam*, those which ripen in the month of Kanni (September); and (3) *Nēēla ēlam*, or long cardamoms.

The first two classes grow on the same variety of the plant, the whole plant being smaller than that of the long variety, and the difference in the time of ripening is due to differences of altitude and climate.

The scapes on which the capsules are borne, in the case of the first two classes, always trail on the ground, whereas the scapes of the long cardamoms stand erect, and are often 2½ ft. high.

Magara ēlam are considered the best. The plants that produce them are grown at an elevation of 3,000 ft. and upwards on the eastern edge of the Travancore Territory, where the rainfall is comparatively light, reaching probably not more than 60 inches. In this comparatively dry district the capsules take longer to mature, and though the plant flowers in March and April, at the same time that it flowers elsewhere, the capsules do not ripen till January, and are considerably larger and contain more seed than the other kinds.

Kanni ēlam come second. The capsules are very round and sweet, but are smaller than those of the *Magara ēlam.* The plants which produce them grow at elevations between 1,000 and 2,500 ft., in a moister (100—200 inches) and more forcing climate than the others, and the fruit ripens more quickly.

Nēēla ēlam come last. The plants are larger, and the scapes stand upright as already said. The capsules are long and less aromatic than those of the other two kinds. This variety is found on the hills of South Travancore, where the rainfall is heavy (150—200 inches) and where the sea breezes blow. The elevation is between 1,000 and 3,000 ft.

Although cardamoms are wild in the forests, they have been cultivated in gardens from time immemorial, and from old records it is seen that the oldest gardens which were in existence when Lieut. Ward made his survey of the country in 1817 are still the most productive. These gardens are found on the eastern edge of the Travancore hill-plateaux, where the *Magara ēlam* are produced, and this variety yields about $\frac{3}{4}$ of the total produce of the country. Some gardens are met with in the *Kanni ēlam* district, but these are more modern, and the yield is about $\frac{1}{6}$ of the total crop each year. "Long cardamoms" are not grown in gardens; they are all collected wild from the forests.

When a person intends to open a garden, and has obtained permission to do so (for cardamoms are still a monopoly in Travancore), he selects some heavy forest, where there are already a few plants of cardamoms growing, carefully avoiding those places where reeds grow, as indicating poor soil. The common saying is that where the Anjili (*Artocarpus hirsuta*) and white cedar (*Dysoxylon malabaricum*) grow, there cardamoms will thrive.

The smaller trees and undergrowth are then cut down, only the larger trees being left to form a close canopy overhead. The garden is then kept clear of weeds by a cutting over and weeding twice a year, and cardamom seeds are sprinkled about, or the rhizomes are planted out when the plants have not come up properly. In about 3 years the garden begins to bear, and may continue to do so for upwards of a century if the light is not allowed to enter too much. Should any of the larger trees fall down and let the light in, the cardamom plants turn yellow and give a heavy crop, but then die out until shade has been again allowed to grow up.

Each year when the cardamoms ripen, they are collected and dried on rocks, and when thoroughly dried they are delivered to the Cardamom Superintendent, who weighs them in and despatches the crop under escort to the Court, where it is sold, and the grower gets two-fifths of the price realised at the annual auction, the Government retaining the other three-fifths.

The crop yielded per acre is not large, and, indeed, a heavy crop is a disadvantage, as it would imply that the garden was about to die out. Equal crops of good full capsules are to be desired, and as the trees above drop their leaves and manure the plants below, no further manuring is necessary, though it is generally admitted that manuring would largely increase the crops were it feasible to carry out such operations.

It has been estimated that there are about 26,000 acres under cardamoms in Travancore, and 13,000 thulams (of 20 lbs. each) is a large crop. Even supposing that the area was much over-estimated, it is probable that the annual crop does not exceed 10 lbs. to the acre, though we have heard it placed at double that amount.

It will be seen by the figures quoted above that the crops of cardamoms in Travancore vary very considerably, the fact being that the setting of the blossom in March, April and May is very much dependent on the weather, frequent showers during those months being most favourable to a good crop, while a heavy monsoon is said to destroy the young fruit. Here too, as in the case of most fruit crops, a good year is followed by one or two bad ones and *vice versâ.*

Formerly, when Travancore used to supply the world with this spice, the price realized was very good, but since Ceylon and Curg cardamoms have come into the market, the price has fallen to about ¼ of its former level, so that the annual amount realized by the Government hardly pays for the establishment required to watch and guard the crop from being stolen. The owners of gardens, who are chiefly villagers from the adjoining district of Madura in British India, scarcely secure any return for their work, and it is now in contemplation to abolish the monopoly altogether.

A considerable proportion of the cardamoms in Indian commerce consists of the seeds, without the husks. These seeds are obtained from overripe fruits which have burst in the field or during manipulation, and are of two kinds, Indian and Chinese. The latter are said to be the seeds of *Amomum xanthioides.* (*Hanbury, Science Papers*, pp. 100, 178, 250, 291.)

Amomum subulatum, *Roxb.*, is much larger than the true cardamom, of a dark-brown colour and coarsely striated, three-valved, each valve being furnished with three ragged, membraneous wings, which extend from the upper part of the fruit and gradually disappear towards the apex. The seeds are arranged as in the true cardamom, but are more numerous, and are held together in each cell by a dark viscid saccharine pulp. Their taste is aromatic and camphoraceous. They are much used in the preparation of sweetmeats on account of their cheapness. Value, Rs. 12 per maund of 37½ lbs.

The **Nutmeg Cardamom,** or true **Cardamomum majus,*** made its appearance in the Bombay market in 1885. Up to that time the only large cardamoms we have met with have been the Bengal or Ceylon kinds. Under the name of Hil-bawa it is correctly described by the Arabian physicians, who no doubt were acquainted with the genuine article. Persian and Indian writers are evidently not acquainted with it, although they copy the description given by the Arabs.

The *Pharmacographia* has the following account of this rare Cardamom:—"The true *Cardamomum majus* is a conical fruit in size and shape, not unlike a small fig reversed, containing roundish angular seeds, of an agreeable aromatic flavour, much resembling that of the Malabar cardamom, and quite devoid of the burning taste of grains of Paradise. Each fruit is perforated, having been strung on a cord to dry; such strings of cardamoms are sometimes used by the Arabs as rosaries. The fruit in question is called in the Galla language *Korarima*,

* Valerius Cordus, Hist. Plant. iv., 28 ; Mathiolus i., 27.

but is also known as *Guragi* spice, and by its Arabic names of *Heil* and *Hab-el-habashi*. According to Beke, it is conveyed to the market of Báso (10° N. lat.), in Southern Abyssinia, from Tumhe, a region lying in about 9° N. lat. and 350 E. long.; thence it is carried to Massowah, on the Red Sea, and shipped for India (?) and Arabia. Von Heuglin speaks of it as brought from the Galla country. It is not improbable that it is the same fruit which Speke saw growing in 1862 at Uganda, in lat. 0°, and which he says is strung like a necklace by the Wagonda people.

ALPINIA OFFICINARUM, *Hance.*

Fig.—*Bentl. and Trim., t.* 271. The lesser Galangal (*Eng.*), Petit Galanga, Galanga de la Chine (*Fr.*).

Hab.—China. The rhizome.

Vernacular.—Kulinjan, Pán-ki-jer (*Hind.*), Shitta-rattai (*Tam.*), Kulinjan (*Mar.*), Kulanjan (*Guz.*), Kunjara-kathi (*Sind.*), Sannaclumparásh-trakum (*Tel.*), Kalanjan (*Can.*).

History, Uses, &c.—The Chinese call the Galangals *Kaon-leang-keang* and *Liang-keang*. From the first of these names the Arabs have derived their name Khulanjan or Khowlanján, which is applied to the greater and lesser galangal, and is the source of the European name for these drugs. The same name occurs in the Nighanta's, which makes it evident that the Hindus first became acquainted with Chinese galangal through the Arabs. The earliest notice of the drug occurs in Persian literature (cf. *Burhan*), where it is stated that Khusrú-dárú, "Chosros remedy," was introduced in the time of Noshirwan (6th century). It probably reached Persia by the Central Asian trade route, as we find that it is still used by the Tartars to flavour their tea. Paulus Ægineta (7th century) calls it γαλάγγας, and latter Greek writers χαιλίζεν, γαλάβκας and κολουτζία. Ibu Khurdádbah (9th century), in enumerating the productions of a country called Sila, names galangal, and Edrisi, three hundred years later, mentions it as brought from

India and China to Aden. Ibu Sina and other early Arabian physicians also notice it shortly as a stomachic and stimulant. Curious stories as to its source were current in those days; Haji Zein states that in Yunán a kind of hawk is said by travellers to build its nest of the roots of the Khúlanján upon the sea-shore, and that the only way of obtaining the drug is to rob these nests; this the merchants do, and, after washing the roots, cut them up into short pieces.

Although this drug has been so long known, its botanical source was only discovered in 1870, when a description of the plant was communicated to the Linnean Society of London by Dr. H. F. Hance, made from specimens collected by M. E. C. Taintor near Hoihow, in the north of Hainan. (*Journal of the Linn. Soc.*, 1873, XIII., 6.)

Galangal is described by Serapion on the authority of Ishák bin Amrán as hot and dry in the third degree, useful to phlegmatic persons, and in humidity of the stomach; it promotes digestion by its heat and the solution which it occasions in the stomach, and thus relieves colic; gives fragrance to the breath, and warms the kidneys: it sets the semen in commotion, and when a piece of it is held in the mouth it occasions erections of the *membrum virile*. Other Arabian writers give a similar account of it. Indian Mahometan writers, with reference to the name Pán-kí-jar, say that the drug may be the root of very old plants of *Piper Betle*, but they are evidently in doubt about its being produced by that plant. (*Makhzan, article "Khúlanján."*) Mír Muhammad Husain describes Galangal as tonic, stomachic, carminative, stimulant, and aphrodisiac. He tells us that if given to young children it makes them talk early, and that a paste of the powdered drug made with oil or water will remove freckles. It is a stomachic tonic, used by native practitioners to reduce the quantity of urine in diabetes. It is used to correct foul breath when chewed, and the juice swallowed stops irritation in the throat. (*Emerson.*) Galangal is one of the ingredients of Warburg's tincture. It is not used in English medicine, but there is a considerable demand for it in Russia, where it is

used for a variety of purposes, as for flavouring the liqueur called *Nastoika*, it is also employed by brewers, and to impart a pungent flavour to vinegar, a use noticed by Pomet so long ago as 1694. As a popular medicine and spice, it is much sold in Livonia, Esthonia, and in Central Russia. It is also in requisition as a cattle medicine, and all over Europe there is a small consumption of it in regular medicine (*Hanbury*). Irvine (*Med. Topog. of Ajmeer*, p. 171) says that the natives add Kulijan to bazar spirit to make it more intoxicating.

Description.—The dried rhizomes are about as thick as the little finger or often less. They have evidently been cut into short lengths (2 to 3 inches) while fresh; many of the pieces are branched, and all are marked by numerous circular ridges of a light colour. The external surface of the rhizome is of a deep reddish-brown, the interior pale red, hard and tough; the odour is aromatic and the taste hot and spicy.

Microscopic structure.— The bulk of the rhizome consists of a uniform parenchyma traversed by fibro-vascular bundles, some of the parenchyme cells are full of resin and essential oil, but most of them contain large starch grains of an elongated or club-shaped form.

Chemical composition.— Galangal contains from $\frac{1}{5}$ to $\frac{1}{2}$ per cent. of an essential oil, which is the odorous principle; according to Vogel, its formula is $C^{10}H^{16}O$. Brandes extracted from Galangal with ether a neutral, inodorous, tasteless, crystalline body, *Kæmpferide*. E. Jahns (1883) has isolated the following compounds from the root: *Kämpherid*, $C^{16}H^{12}O^{6}H^{2}O$, crystallizing in yellowish needles (m. p. 221°), which are slightly soluble in water, ether and benzine, freely soluble in alcohol, soluble in alkalies to an intensely yellow solution, and in concentrated sulphuric acid to a yellow solution with a strong blue fluorescence. *Galangin*, $C^{15}H^{10}O^{5}H^{2}O$, crystallizing from its solution in aqueous alcohol in yellowish-white needles (m. p. 214°). The reactions of this body are very similar to those of kampherid; its solution in concentrated sulphuric acid, however, is non-fluorescent.

Alpinin, $C^{17}H^{12}O^{6}$, crystallizes in yellowish needles (m. p. 173°). Its reactions are similar to those of galangin. (*Archiv. der Pharm.*, CCXX., 161; *Year-Book of Pharmacy*, 1882, p. 199.) The resin, which is probably the acrid principle, has not been examined.

Dr. Thresh (1884) has isolated from Galangal root an active pungent principle, which he has named *Galangol*, and which resembles the pungent principles of Ginger, Capsicum, and grains of Paradise in certain respects. He records the following proximate analysis of 100 parts of the rhizome:—Volatile oil 0·6, resin 0·2, fat and *Galangol* 1·6, kampferid, &c., 1·4, other saline matters soluble in ether but not precipitated by Pb. A^{2} 1·2, tannin 0·6, phlobophane 1·2, other substances soluble in alcohol 3·2, glucose, mucilage, &c., 3·5, oxalic acid 0·3, galangal red 2·8, starch 23·7, albuminoids 2·6, moisture 13·8, ash 3·8, cellulose, &c., 39·5. The active principle could not be isolated in a state of purity.

Commerce.—The imports of Galangal into India average 3,300 cwts. yearly. In 1883-84 they amounted to 3,870 cwts., valued at Rs. 35,982, of which Calcutta took 686 cwts., Bombay 1,750 cwts., and Madras 1,434 cwts. Of the total imports 1,230 cwts. came from Hongkong, 2,540 cwts. from the Straits Settlements, and 100 cwts. from other countries. During the same year 1,670 cwts. were re-exported to Arabia and Persia.

Galangal is valued in Bombay at about Rs. 3½ per maund of 37½ lbs.

ALPINIA GALANGA, *Willd.*

Fig.—*Rumph. Amb. v.*, *t.* 63. The greater Galangal, Java Galangal (*Eng.*), Galanga grand, Galanga de Java (*Fr.*).

Hab.—Java, Sumatra, Southern India. Cultivated in Bengal. The rhizome.

Vernacular.—Bara-Kulinjan (*Hind.*, *Guz.*), Motha-kolanjan, Kosht-kolanjan, Malabari-kolanjan (*Mar.*), Pera-rattai (*Tam.*), Pedda-dumparash-trakan (*Tel.*), Pera-ratta (*Mal.*).

History, Uses, &c.—The great Galangal is known in China by the same names as the lesser Galangal, and does not appear to have been distinguished from the latter drug by the Greeks, Arabs or Persians. Hanbury (*Science Papers*, p. 373) remarks that Garcia D'Orta was the first writer to point out (1563) that there are two kinds of Galangal—the one, as he says, of smaller size and more potent virtues, brought from China, the other, a thicker and less aromatic rhizome, produced in Java. Loureiro describes the plant which produces it under the name of *Amomum Galanga*, and gives Câo Leâm Kiâm as its name in Cochin-China. Roxburgh (i., 60) fully describes the plant grown in Calcutta from roots sent to him by Dr. Charles Campbell from Bencoolen, and quotes a note by Mr. Colebrooke to the effect that the roots are the Kulanjana of the Raja Nirghanta, and the Sughanda-vacha and Malabari-vacha of the Bhavaprakasha. From the latter name it appears that the Hindus regard the plant as a native of Malabar or of Western India; the correctness of this opinion has been confirmed by Dalzell and Gibson, who found it growing truly wild upon the Wagh Dongar or "tiger hill" in the Southern Concan. (*Bomb. Fl.*, p. 274.) The root of the Indian plant does not, however, appear to have been collected for commercial purposes until a comparatively recent date, which has given rise to the supposition that the plant is not a native of India. At the present time it is cultivated both in Malabar and Bengal.

The fruits of *A. galanga* furnish the Galanga Cardamom. In the fresh state they are of the size of a small cherry, obovate, smooth, and of a deep orange-red colour. Hanbury (*Science Papers*, p. 252) describes the dried fruit (*Kaon-leang-keang-tsze*, Chinese) as about half an inch in length, of an oblong form, somewhat constricted in the middle, or occasionally pear-shaped; some obscurely 3-sided. Each fruit prominently crowned with the remains of the calyx; in a few the lower extremity still attached to a slender pedicel. Most of the capsules much shrivelled on the outside, a few plump and smooth. Pericarp from pale to deep reddish-brown, glabrous, thin. Seeds united in a 3-lobed mass, completely invested in

a whitish integument, each cell or lobe containing usually two, placed one above the other; these are ash-coloured, flattish, and somewhat 3-angled, finely striated, and have a pungent taste like that of the root. (*For figure, see Science Papers*, p. 107.)

The root is readily distinguished from that of *A. officinarum* by its larger size, feebler odour and taste, orange-brown exterior and yellowish-white interior. The statistics of Indian commerce do not enable us to distinguish this drug from China galangal.

It is valued in Bombay at about Rs. 50 per candy of 7 cwts. Galangal cardamoms are not found in Indian commerce.

In the Kew *Bulletin* for January 1891 (p. 5) an interesting account is given of the identification of the plant yielding the rhizome employed to make the well-known Chinese preserved ginger. As long ago as 1878, Dr. E. Percival Wright, of Trinity College, Dublin, called the attention of Mr. Thiselton Dyer to the fact that the preserved ginger has very much larger rhizomes than *Zingiber officinale*, and that it was quite improbable that it was the produce of that plant. The difficulty in identifying the plant arose from the fact that, like many others cultivated for the root or tuber, it rarely flowers. The first flowering plant was sent to Kew from Jamaica by Mr. Harris, the Superintendent of the Hope Garden there. During the past year the plant has flowered both at Dominica in the West Indies and in the Botanic Garden at Hongkong. Mr. C. Ford, the Director of the Botanic Garden at Hongkong, has identified the plant as *Alpinia galanga*, the source of the greater or Java galangal root of commerce. Mr. Watson, of Kew, appears to have been the first to suggest that the Chinese ginger plant is probably a species of *Alpinia*, and possibly identical with the Siam ginger plant, which was described by Sir J. D. Hooker in the *Botanical Magazine* (tab. 6946) in 1887 as a new species, under the name of *Alpinia zingiberina*. Mr. J. G. Baker, in working up the Scitamineæ for the 'Flora of British India,' arrived at the conclusion that it is not distinct from the *Alpinia galanga*,

Willd. The Siam and Chinese gingers are therefore identical, and both are the produce of *Alpinia galanga*, Willd. *Pharm. Journ.*, Jan 31st, 1891.

MUSA PARADISIACA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 275; *Rheede, Hort. Mal. i. tt.* 12—14. Plantain (*Eng.*), Bananier (*Fr.*).

Hab.—Cultivated throughout India. The fruit, leaves and stems.

Vernacular.—Kéla (*Hind., Guz.*), Kala (*Beng.*), Kél (*Mar.*), Vazhai-pazham (*Tam.*), Anati-pandu, Amti-pandu (*Tel.*), Báli (*Can.*).

History, Uses, &c.—The cultivated plantains are called Kadali in Sanskrit, and the wild plantains, which, we believe, to be their progenitors, Aranya-kadali and Rambhà. There are many synonyms, such as Bhánuphala or Ansumatphala "having luminous fruit," Chárupbala "having delicious fruit," Rájeshta "liked by kings," Vana-lakshmi "beauty of the woods," &c. We think there can be little doubt that the plantain has been under cultivation in India from prehistoric times. The Greeks under Alexander must have become acquainted with it; Theophrastus and Pliny describe a tree called *Pala*, with leaves like the wing of a bird, three cubits in length, which puts forth its fruit from the bark, a fruit remarkable for the sweetness of its juice, a single one (bunch?) containing sufficient to satisfy four persons; this tree is supposed to have been the plantain. The word *pála* signifies "leaves," but we are not aware of its ever having been applied to the plantain. The Arabs call it *Mauz* and *Talk*, and under the latter name it is mentioned in the Koran—و اصحاب اليمين ما اصحاب اليمين* فى سدر مخضود و طلح منضود (and the companions of the right hand, happy companions of the right hand among Lotus trees free from thorns, and plantains with their lapping clusters of fruit).

Under the name of Mauz, Mesne describes the fruit as useful in soreness of the throat and chest with dry cough, and in

irritability of the bladder; he considers it to be aphrodisiac, diuretic and aperient, and recommends it to be cooked with sugar or honey. Eaten in excess it gives rise to indigestion. Abu Hanifeh in the 9th century described very accurately the manner of growth of the plantain, and quotes a saying of Ash'ab, to his son, as related by As, "Wherefore dost thou not become like me?" to which he answered, "Such as I is like the *Mauzah*, which does not attain to a good state until its parent dies." (*Madd-el-kamus.*) The early Italian travellers called the plant *Fico d'Adamo*, and thought they saw in the transverse section of the fruit a cross or even a crucifix. Mandeville calls it the Apple of Paradise. The varieties of the plantain are very numerous; Rumphius describes sixteen (*Herb. Amb.*, viii., 2). Some of these, like the large yellow *Manyel*, are only used after they have been cooked; others, as the *Iclâhi*, are small and delicate in flavour. The abortive flowers at the end of the spike are removed and used as a vegetable by the Hindus, and the unripe fruit, called *Mochaka* in Sanskrit, is used medicinally on account of its astringent properties in diabetes; it is made into a *ghrita* with the three myrobalans and aromatics. Young plantain leaves are universally used as a cool dressing for blisters and to retain the moisture of water dressings; they serve also as a green shade for the eyes. Emerson notices the use of the sap to allay thirst in cholera. Mír Muhammad Husain in the *Makhzan* tells us that the centre of the stem, *Kanjiyál*, is eaten with fish as a vegetable in Bengal, that the kind called *Málbhok* is used as a poultice to burns, and that called *Bolkad* is boiled and used as an ointment to the syphilitic eruptions of children; he also notices the use of the ashes on account of their alkaline properties, and of the root as an anthelmintic. MM. Corre and Lejanne state that the fruit stems sliced and macerated in water all night, yield a sudorific drink; and that the charcoal of the skin of the fruit is recommended by Chevalier as an application to the cracks in the sole of the foot from which Negroes suffer. Pereira (*Mat. Med.*, ii., p. 222) has drawn attention to the nutritive properties of the meal prepared from the fruit. In India the lower

portion of the stem of the wild plantain is a valuable resource in famine seasons on account of the large quantity of starch it contains. Starch prepared from the unripe fruit is used in the treatment of bowel complaints in Bengal. A specimen we examined consisted almost wholly of pure starch, with a trace of astringent extractive. In America a syrup of bananas is said to be singularly effective in relieving chronic bronchitis. The preparation is simple, requiring only that the fruit shall be cut in small pieces and with an equal weight of sugar be placed in a close jar, which is set in cold water and slowly heated to the boiling point, when it is to be removed from the fire and allowed to cool. The dose mentioned is a teaspoonful every hour.

Chemical composition.—Professor Johnston, in the *Journal of the Agricultural Society of Scotland*, says: "We find the plantain fruit to approach most nearly in composition and nutritive value to the potato, and the plantain meal to that of rice. Thus the fruit of the plantain gives 37 per cent., and the raw potato 25 per cent., of dry matter. In regard to its value as a food for man in our northern climates, there is no reason to believe that it is unfit to sustain life and health; and as to warmer or tropical climates, this conclusion is of more weight." The only chemical writer who had previously made personal observations upon this point (M. Boussingault), says: "I have not sufficient data to determine the nutritive value of the banana, but I have reason to believe that it is superior to that of the potato. I have given as rations to men employed at hard labour about 6½ pounds of half-ripe bananas and two ounces of salt meat." Of these green bananas he elsewhere states, that 38 per cent. consisted of husk, and that the internal eatable part lost 56 per cent. of water by drying in the sun. The composition of the ash of the plantain also bears a close resemblance to that of the potato. Both contain much alkaline matter, potash and soda salts; and in both there is nearly the same percentage of phosphoric acid and magnesia. The growing parts of the plant contain much tannic and gallic acids. The sound ripe fruit contains as much as 22 per cent. of sugar, 16 per cent. being crystallizable. In the native sugar-cane the

proportion of cane sugar, according to Payen, is 18 per cent. After the plantain has become quite ripe, there is a rapid diminution in the proportion of crystallizable sugar and an increase in the proportion of inverted sugar; an over-ripe fruit contained only 2·84 per cent. of crystallizable and 11·84 per cent. of uncrystallizable sugar, being a total of 14·68 per cent. or two-thirds of the original quantity.

For the following analyses of E. Indian plantains we are indebted to Assistant Surgeon C. L. Bose, Calcutta. The samples represent the most commonly-used varieties:—

Percentage of Pulp and Pericarp in Ripe Fruit.

Variety.	Pulp.	Pericarp.
Kantali	70·85	29·15
Champa	74·37	25·63
Chattim	86·02	13·98

Percentage Composition of Pulp.

Variety.	H_2O.	Ash.	Alkalinity of Ash in terms of Normal KHO.	Cane Sugar.	Grape Sugar.	Total Sugar.	Gum.	Total acidity of Pulp in terms of Normal NaHo.	Fat.	Total N.	Albuminoids, N × 6·25.	Non-nitrogenous extractives by difference.
Kantali	67·68	·77	7·09 c. c.	8·36	7·75	16·11	·48	8·90 c. c.	·058	·2	1·35	13·657
Champa	71·47	·97	8·08 c. c.	...	...	14·15	·401	7·87 c. c.	·135	·288	1·80	11·109
Chattim	73·32	·73	7·34 c. c.	10·37	7·41	17·78	·36	4·57 c. c.	·00	·24	1·50	6·31

König gives the following as the composition of the fruit from Brazil and Venezuela—the first analysis being by Corenwinder, and the other by Marcano and Müntz :—

	Brazil.	Venezuela.	*Mean.*
Water	72·40	73·8	73·10
Albuminoids	2·14	1·60	1·87
Fat	·96	·30	·63
Nitrogen free extractive	23·09	23·00	23·05
Cellulose	·38	·20	·29
Ash	1·03	1·10	1·06

The fruit consisted of about 40 per cent. pericarp and 60 per cent. pulp. The pericarp afforded 14·7 per cent. of solid residue, containing 1·6 per cent. of grape sugar. The anhydrous fruit from Brazil contained 1·24 per cent. nitrogen and 83·66 per cent. carbohydrates; that from Venezuela, ·97 per cent. nitrogen and 87·78 per cent. carbohydrates. Plantain meal from Venezuela had the following percentage composition :—

Water	14·90
Albuminoids	2·90
Fat	·50
Nitrogen free extractive	77·90
Cellulose	1·60
Ash	2·20

The nitrogen free extractive from the ripe fresh fruit and meal had the following composition :—

	Brazil.	Venezuela.	Meal.
Cane sugar	15·90	5·90	1·52
Grape sugar	8·50	6·40	3·30
Starch	·60	·40	66·10

The ash of the fruit from Brazil had the following percentage composition :—Potassium sulphate, 3·61 ; Potassium chloride, 14·34 ; Magnesium phosphate, 8·77 ; Potassium oxide, 27·12 ; Potassium carbonate, 41·66 ; Calcium carbonate, 1·17 ; Oxide of iron, ·36 ; Sand, 2·06 per cent.

The ash of the husk of the ripe fruit was found to contain 47·98 carbonate of potash, 6·58 carbonate of sodium, 25·18 chloride of potassium, 5·66 alkaline phosphates (with a little sulphate), 7·50 charcoal, 7·10 lime, silica, earthy phosphates, &c. In the juice of the flower stem of the same plant, Comnille (*J. Pharm.* (3) 43, 269) found 25·27 per cent. potash, 9·52 soda, 15·85 lime, 5·0 magnesia, 0·87 alumina, with a trace of ferric oxide, 6·30 chlorine, 0·96 sulphuric anhydride, 0·87 phosphoric anhydride, 0·81 silica, and 34·17 carbonic anhydride (calculated from the bases).

Commerce.—Dried plantains are an article of commerce in India, and are excellent when stewed with sugar or fried in butter. Bombay exports annually from 300 to 400 cwts.

CANNA INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. xi.*, *t.* 43. Indian Shot or Bead (*Eng.*), Balisier (*Fr.*).

Hab.—Uncertain. Common throughout India in gardens and cultivated ground. The fruit and root.

Vernacular.—Sabba-jaya, Akalbar (*Hind.*), Sarba-jaya (*Beng.*), Kandámani-cheddi (*Tam.*), Krishna-tamara (*Tel.*), Kátú-búla (*Mal.*), Sugundaraju-gida (*Can.*), Deokeli, Kámákshi (*Mar.*).

History, Uses, &c.—This plant, though common everywhere, is not truly wild in India; how and from whence it has been introduced is not known; it occurs also in Burma and Ceylon, and the seeds are used as prayer-beads by the Burmese. In the West Indies, especially in St. Kitts, a nearly allied species is cultivated for its starch, which is known as "*Tous les mois*" or "*Fécule de Tolomane,*" and is remarkable for the great size of its starch grains. No starch is prepared in India from *C. indica*, but its fruit and root are used medicinally by the natives. The flowers are sacred to Shiva and Durga, as is indicated by the Hindi, Bengali, and Marathi names which are derived from the Sanskrit Sarva-jaya "all conquering" (Shiva), and Kámákshi, a name of the goddess Durga. In the *Dict. Econ. Prod. of India*,

the Sanskrit name Silarambha is wrongly attributed to this plant, it is properly the name of the wild plantain or Káshtha Kadali. Rheede, describing the medicinal uses of *C. indica,* says:—"E fructibus parvum tostis succus elicitur, qui auribus immissus dolores illarum mitigat. Ex iisdem et saccharo massa componitur, et umbilicali regioni applicatur contra diabetem, ex calidis febribus ortam. Succus radicis Mercurii sublimati toxicum infringit." Atkinson (*Him. Dist.* 730) states that the root is used as a diaphoretic and diuretic in fevers and dropsy. When cattle have eaten any poisonous plant, which is generally discovered by the swelling of the abdomen, the natives administer to them the root of this plant, which they break up in small pieces, boil in rice-water and pepper, and give them to drink. (*Drury.*) Baden-Powell (*Punj. Prod.* 382) states that the seeds are considered to be cordial and vulnerary.

Description.—An herbaceous plant, 2-3 feet; leaves large, ovate-lanceolate, stem-clasping; flowers bright scarlet or yellow, inner wing of the corolla trifid, segments lanceolate, straight; anther single, attached to the edge of the corolla; capsule bristly, 3-celled, many-seeded; seeds round, black, hard and shining, the size of a pea or buck-shot.

Chemical composition.—The seeds reduced to powder were exhausted with alcohol, and the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, then with ether, and after the addition of an alkali, again with ether.

The petroleum ether extract contained yellowish fatty matter, from which white nodules separated on standing, the taste was camphoraceous and somewhat pepper-like. The acid ether extract had the odour of vanilla; it was partly soluble in water with acid reaction, the aqueous solution giving a bright green coloration with ferric salts, slightly precipitating gelatine, but giving no reaction with potassic cyanide.

No alkaloidal principle was detected in the ether extract, the amount of which did not exceed a trace.

The fresh roots were contused, and treated in the same manner as the seeds. The taste of the alcoholic extract was

slightly pungent with a flavour of ginger. The petroleum ether extract was yellow and consisted of resinous and fatty matters; it was partly soluble in absolute alcohol, the solution giving a dirty-green precipitate with ferric chloride. The acid ether extract was partly soluble in water, and the solution gave a sage-green coloration with ferric chloride, precipitated tannin, but gave no reaction with potassic cyanide. The portion insoluble in water was nearly wholly soluble in ammonia, affording a deep yellowish-brown solution, from which acids precipitated yellowish flocks. The alkaline ether extract contained traces of an alkaloid which failed to afford any special colour reactions.

The seeds have been stated by Dalzell and Gibson (*Bombay Flora*) to afford a beautiful but evanescent dye; we failed to detect the presence of any such dye principle in either the seeds or roots. The roots contain mucilaginous matter and starch; starch was also present in the seeds.

IRIDEÆ.

IRIS GERMANICA, *Linn.*

Fig.—*Bot. Mag., t.* 670; *Bot. Reg., t.* 818. Orris root (*Eng*)., Racine d'Iris (*Fr.*).

Hab.—Central and Southern Europe, Northern India, and Persia. The rhizome.

Vernacular.—Bikh-i-banafshah, Keore-ka-mul (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. II., p. 296) that we consider Orris root to be the Pushkara-mula of Sanskrit writers, though it is not now recognised as such by the modern Hindus. It appears also to be the Kusht-el-bahri and Kusht-el-hali, "sweet costus," of the Arabs. The Greek name Iris is probably of Persian origin, and cognate with Aersa, and probably with Arastan, an old form of Árástan, "to adorn, to obey." Among Sanskrit synonyms for Pushkara-mula, we find Padma-pushkara "blue lotus," Pushkaránghrija "born of the lotus root," Pushkaráhva "challenging the

lotus," Pushákarasgara "sea lotus," and Kasmira "Cashmerian"; at the present time *I. nepalensis* is called "blue lotus" in Kumaon. The root is described as having properties similar to costus, and appears to have been regarded by both Hindus and Arabs as a kind of costus. In the Burhán the plant is said to be called Irsa, because its flowers are blue, yellow and white like the rainbow; it is also called in Persia Susán-i-asmánguni, "sky-coloured lily." The Iris is mentioned by Theophrastus (H. P. iv., 7; ix. 7), Dioscorides (i., 1), and all the Greek medical writers which we have consulted. A celebrated unguent, the ἴρινον μύρον, was prepared from the root for which Macedonia, Elis and Corinth were famous. Visiani (*Fl. Dalmat.*) considers that the *I. germanica* is the Illyrian iris of the ancients, which is highly probable, seeing that throughout Dalmatia (the ancient Illyricum) that species is plentiful, and *I. florentina* and *I. pallida* do not occur. According to Hooker, *I. germanica* is cultivated in Cashmere, but we have not heard of its being under cultivation in Persia. The Persian name of this drug, Bikh-i-banafshah, is applied also to the root of *Viola odorata* in Southern India.

Iris root is considered by Mahometan hakíms to be deobstruent, aperient, diuretic, especially useful in removing bilious obstructions. It is also used externally as an application to small sores and pimples. From the large number of diseases in which this drug is recommended, it would appear to be regarded as a panacea.

Description.—Eastern orris root differs from the European drug, inasmuch as the bark of the rhizome has not been removed; it is also smaller and of a darker colour.

Microscopic structure.—The rhizomes of different species of Iris hardly differ in structure. They consist of a brown epidermis composed of compressed and nearly empty cells, covering a white cortical cellular tissue containing starch; this is separated by a layer of brownish compressed empty cells from the central woody yellowish tissue of the rhizome. The latter is built up of large thick-walled, spherical, porous cells,

loaded with starch; here and there between the cells may be seen a prism of oxalate of lime. The vascular bundles are numerous, in each irregular rings of spiral vessels surround a central bundle of jointed vessels.

Chemical composition.—The authors of the *Pharmacographia* say:—"When Orris root is distilled with water, a solid crystalline substance, called *Orris Camphor,* is found floating on the aqueous distillate. This substance, which we obtained from the laboratory of Messrs. Herrings & Co., of London, is yielded, as we learn from Mr. Umney, to the extent of 0·12 per cent., that is to say, 3 cwt. 3 qrs. 23 lbs. of rhizome afforded of it 8½ ounces. Messrs. Schimmel & Co., of Leipzig, also presented us with the same substance, of which they obtain usually 0·60 to 0·80 per cent. Orris camphor has the exquisite and persistent fragrance of the drug; we have proved that this presumed stearoptene or Camphor of Orris root consists of *myristic acid,* $C^{14}H^{28}O^{2}$, impregnated with the minute quantity of essential oil occurring in the drug. The oil itself would appear not to pre-exist in the living root, but to be formed on drying it.

"By exhausting Orris root with spirit of wine, a soft brownish resin is obtained, together with a little tannic matter. The resin has a slightly acrid taste; the tannin strikes a green colour with persalts of iron."

Commerce.—India is supplied with Orris root from Persia and Cashmere. The average value is about 2 annas per lb.

CROCUS SATIVUS, *Linn.*

Fig.—*Bentl. and Trim., t.* 274; *Woodv., t.* 259; *Royle, Ill., t.* 90. Saffron (*Eng.*), Saffran (*Fr.*).

Hab.—Greece, Asia Minor, Persia. Cultivated elsewhere. The stigmas with portions of the styles.

Vernacular.—Késar (*Hind.*), Késhar (*Mar., Guz.*), Jáfrán (*Beng.*), Kunguma-pu (*Tam.*), Kunkuma-puvva (*Tel.*), Kunkumadahuvu, Késari (*Can.*), Kunkuma-puvva (*Mal.*).

History, Uses, &c.—Saffron, on account of its brilliant yellow colour, like that of the rising sun, has been especially valued by mankind from the earliest ages; in Sanskrit it bears the name of Kunkuma (a name also given in India to the red colour prepared from turmeric), and is described as Charu "fair," Vara "suitor," Agnisikha "having a crest of fire," Saurabha "fragrant," Mangalya "propitious," &c. In Persia the word *Zard*, derived from the Zend, signifies "yellow, and saffron," and the sun is called *Zard-ru* "yellow or golden-faced," and Zardah-i-kamrân "the fortunate yellow." Saffron is the Karkôm of the Hebrews, a name borrowed from the Persians, and in the *Song of Solomon* the beauty of the bride is likened to it. Amongst the Greeks κροκος signified both saffron and yellow; *Eos* or Aurora, the goddess of the morning, is clothed in it, and in Homer she is described as accompanying the Sun throughout the day.

Yellow, and plants having that colour, have also an erotic signification, hence we find them playing an important part in marriage ceremonies and the relations between the sexes: Juno in the *Iliad* is represented as preparing a bed of saffron and hyacinths when she wishes to tempt Jove, and Jayadeva in the *Gita Govinda* represents Hari as inviting Radha to repose upon a bed made of the saffron-coloured flowers of the Asoka. The following lines indicate the significance which is attached to this colour in popular estimation in India:—

Sánjh suni piyá ávan piyári, sundar nári singár banái,
Piar kesar, piar besar, piar hár liya larkái,
Piar chir diyo kamlápati, piar chandan de lagái,
Piar pán ki biri lagi, piyári piri bhai, piu nahin ái.

"The loved one heard that her lover would come in the evening, and made a grand toilette: yellow saffron, a yellow nose-ring, and a threaded necklace of yellow flowers. She has donned a yellow robe, applied yellow sandalwood, and placed ripe yellow betel leaves in her mouth. The damsel herself has grown yellow waiting for a lover who has not come."

The Grecian Hetairæ and also effeminate youths used to wear the κροκωτος, or "saffron-coloured garment," and the Arabs

relate that Abu Jahl dyed his است (*ist*) with saffron, and was addicted to the enormity, termed ابنة (ubnah). He was a great enemy of the Prophet's, and is promised in the Koran a taste of Hell (و نذيقه يوم القيامة عذاب الحريق). A similar use of saffron by the libidinous old witch Zatel-Dawahi is mentioned in the 93rd night of the *Arabian Nights* :—وكان اكثر اقامتها عند ولدها حردوب ملك الروم لاجل الجوارى الابكار لانها كانت تحب السحاق وان تأخرعنها تكون في انمحاق وكل جاريه اعجبتها تعلمها الحكمة و تسحق عليها الزعفران فتغشى عليها من فرط اللذة مدة من الزمان

Magic properties are ascribed to saffron in Persia; Haji-Zein-el-Attár (1368) states that it is called Jádú-i-dihkán, "peasant's magic," and that pregnant women wear a ball of it, about the size of a walnut, at the pit of the stomach to ensure speedy delivery and expulsion of the after-birth. The saffron bag was not unknown in Europe in the Middle Ages, and even later. The Arabs believe that saffron kept in the house will drive away the lizard called *Sam Abras*, which they greatly dread; they also say of a man who is melancholy or a little odd انه لفى صفرة (innahu lafi sufrihi), *i.e.*, that he is in a state in which he requires to be rubbed with saffron.

Zardáb, or saffron water, is considered to have magical virtues in Persia, and we hear Indian conjurors ascribe the same virtues to turmeric water when they say *Pihalad áni ho gora* in the sense of "Hocus Pocus," &c. Saffron ink is used in India to write *Mantras* with. That auspiciousness is attributed to these plants on account of their colour, and not on account of any inherent properties, is shown by the fact that other plants furnishing yellow dyes are considered auspicious. In Persia *Delphinium Zalil* is much esteemed as a yellow dye, and is even brought to India for that purpose, where it bears the Sanskrit names of Tráyamána "preserving," Mangalya "auspicious," &c. It is quite possible that this plant was used in ancient Iran before saffron, as the word *tráyamána* occurs in old Persian with the meaning of "yellow." Dr. Aitchison speaks of *D. Zalil* as very common in Khorasan, and remarks that when in flower it gives a wondrous golden hue to the pastures.

A yellow colour is considered most auspicious in the East. Vasanta, or Spring, and Krishna are represented as clothed in this colour, and Vasanti-coloured garments are worn at the *Basant panchami* in many parts of India; at this season also garlands of yellow flowers are offered. This custom is alluded to in the *Báramása*, where the wife says:—

Nahin ghar kanth, leke basant ai ghar málan,
Main kaise pújún, sakhi, nahin ghar sájan.

"My husband is away, and the gardener's wife has brought (yellow) spring flowers. How can I make an offering, my dear, when my beloved is absent?"

A yellow garment, called *Basanti*, was worn by the Rajputs when about to sacrifice themselves in a desperate conflict, a sacrifice to their supposed ancestor Surya (the sun). Yellow is the favourite colour of the Buddhists, and the Sakya family was a branch of the great Solar race of Gautama. Sénart considers that the Buddha is the Sun-god, and that the details of his life have been taken from Solar mythology.

The use of saffron and turmeric for colouring and flavouring food is universal throughout India, and saffron is still used for this purpose in Germany, Switzerland, and in Cornwall, cakes made on festive occasions being coloured with it. There is a curious story about saffron-coloured rice in the Persian *Burhán*, where it is called Birinj-i-shamálah, "candle rice." The author relates that in former times there was a cook at Shiraz, who was in the habit of sitting by the roadside every evening and preparing a dish with yellow rice, before which he lighted two lamps, or sometimes two torches, and cried out—"Come to the rice of the candle," and repeated the following couplet:—

این شمعها که در دل بسحاق برفروخت از رهگذار نور برنج شماله بود

"The lights which burnt in the heart of Bushák were kindled by the passing of the light of the rice of the candle."

Who was Bushák, or Bashák? We cannot help thinking that he must have been some sturdy fire-worshipper testifying, as far as he dared, in the presence of a Mahomedan population, to his ancient faith. As the story was an old one when the

Burhán was written, it shows at any rate that the use of saffron-coloured rice in Persia is of great antiquity. The earliest European travellers in India called turmeric *Crocus indicus*, "Indian saffron," and evidently regarded it as a substitute for that article. In those days saffron was of much more importance in Europe than it is now, and the punishment for adulterating it was death.

Saffron was much employed by the Romans for seasoning food, and to make an essence with wine and water which was used as a perfume (*Pliny*, 21, 6, 17; *Lucretius*, ii., 416; *Ovid A. A.* 104, &c.). The name *Záfarán* occurs in the *Siháh* of El Jowhari who wrote in the 10th century, and from Arabian writers (Istakhri, Edrisi) we learn that it was cultivated at this time in Persia at Darband and Ispahán. It is not improbable that the plant was carried from that country to China, as, according to the Chinese, it was introduced by Mahometans. Chinese writers have recorded that under the Yuen dynasty (A. D. 1280—1368) it became the custom to mix Sa-fa-lang (Záfarán) with food (*Bretschneider, Chinese Botanical Works*, Foochow, 1870). Saffron appears to have been cultivated in Spain in the 10th century. The *Rája Nirghanta*, which was written about 600 years ago by a native of Cashmere, speaks of saffron as coming from Cashmere, and the plant is still cultivated there on the Kareewahs* near Pampur; the plants are arranged in parterres, and flower about the end of October; the inhabitants of the district are then summoned to gather the crop; during this time they live in the gardens which are guarded by police to prevent theft (*Ince, Handbook of Cashmere*).

The earliest medical writers mention saffron, and describe it as cardiacal and aphrodisiacal, improving the complexion, increasing the brilliancy of the eyes, and promoting the delivery of women. They also considered it to be diuretic, astringent, deobstruent, and emmenagogue. Saffron, formerly as highly

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* Alluvial flats from 100 to 200 feet high and 2 to 5 miles long, situated along the borders of the Cashmere Valley; they are separated from each other by deep ravines, and have the appearance of flat-topped hills.

esteemed in Europe as in the East, is still considered by some European physicians to have emmenagogue properties, but is generally regarded as a colouring and flavouring agent only. Saffron has recently been deleted from the drug list of the Medical Store Depôts in Bengal. For much interesting information concerning the early history of saffron in Europe, we would refer our readers to the *Pharmacographia* of Flückiger and Hanbury.

Description.—Saffron consists of a small portion of the style and three long tubular stigmas of a rich orange colour; the upper extremity of each stigma spreads out to form a flat lamina with a dentate border. The stigmas simply dried and thrown together loosely, form the ordinary hay saffron of commerce. Persian saffron is, with the aid of some sticky material, pressed together so as to form a thin round flat cake; it is known in Bombay as *Késar-ki-roti* (bread saffron).

Chemical composition.—Flückiger and Hanbury have the following summary:—"The splendid colouring matter of saffron has long been known as *Polychroit;* but in 1851, Quadrat, who instituted some fresh researches on the drug, gave it the name of *Crocin*, which was also adopted in 1858 by Rochleder. The experiments of Weiss in 1867 have shown—

1st—That this substance (Polychroit, Crocin of Rochleder) is a peculiar glucoside, which, by the action of acids, splits into sugar, volatile oil, and a new colouring matter.

2nd—That saffron contains only a minute quantity of ready-formed essential oil and sugar.

3rd—That this free essential oil is probably identical with that which is produced in the decomposition of polychroit.

4th—That polychroit, as hitherto prepared, has always contained a certain proportion of the new colouring matter produced by decomposition."

For the natural glucoside, Weiss retains the name of polychroit, while the new colouring matter which results from its decomposition by an acid he terms crocin. It agrees with the crocetin of Rochleder.

Polychroit was prepared by Weiss in the following manner:—"Saffron was treated with ether, by which fat, wax, and essential oil were removed, and it was then exhausted with water. From the aqueous solution, gummy matters and some inorganic salts were precipitated by strong alcohol. After the separation of these substances, polychroit was precipitated by addition of ether. Thus obtained, it is an orange-red, viscid, deliquescent substance, which, dried over sulphuric acid, becomes brittle and of a fine ruby colour. It has a sweetish taste, but is devoid of odour, readily soluble in spirit of wine or water, and sparingly in absolute alcohol. By dilute acids, it is decomposed into crocin, sugar, and an aromatic volatile oil having the smell of saffron. Weiss gives the following formula for this decomposition:—

$$\underset{\text{Polychroit.}}{C^{48}H^{60}O^{18}}+H^2O=2(\underset{\text{Crocin.}}{C^{16}H^{18}O^6})+\underset{\text{Essential oil.}}{C^{10}H^{14}O}+\underset{\text{Sugar.}}{C^6H^{12}O^6}$$

Crocin is a red powder, insoluble in ether, easily soluble in alcohol, and precipitable from this solution on addition of ether. It is only slightly soluble in water, but freely in an alkaline solution, from which an acid precipitates it in purple-red flocks. Strong sulphuric and nitric acids occasion the same colours as with polychroit, the former producing deep-blue, changing to violet and brown, and the latter green, yellow, and finally brown. It is remarkable that hydrocarbons of the benzol class do not dissolve the colouring matter of saffron.

"The oil obtained by decomposing crocin is heavier than water; it boils at about 209°C., and is easily altered, even by water. It is probably identical with the volatile oil obtainable to the extent of one per cent. from the drug itself, and to which its odour is due.

"Saffron contains sugar (glucose?) besides that obtained by the decomposition of polychroit. It leaves after incineration 5 to 6 per cent. of ash." (*Pharmacographia*, p. 604.)

The investigation of the characteristic constituents of saffron, which had previously occupied the attention of several chemists, has been taken up by Herr Kayser (*Berichte*, xvii., 2228). By distilling saffron suspended in water in a current of carbonic

anhydride, shaking the distillate with ether, and evaporating the ether in a current of carbonic anhydride, the essential oil was obtained as a very mobile, scarcely yellowish coloured liquid, having an extremely intense odour of saffron, readily becoming thick and brown by absorption of oxygen from the atmosphere, and giving upon analysis figures corresponding with the formula $C^{10}H^{16}$. Crocin was obtained by treating an aqueous extract, made without heat from saffron previously exhausted with ether, with purified animal charcoal, which removed all the colouring matter; then filtering, washing and drying the charcoal, boiling it with 90 per cent. alcohol and filtering. Upon removal of the alcohol the crocin was left as a brittle yellow-brown mass, yielding a pure yellow powder, freely soluble in water and dilute alcohol, less soluble in absolute alcohol, and giving up only traces to ether. With concentrated sulphuric acid it gave a deep blue solution, passing to violet, cherry red, and finally to brown; with nitric acid a deep blue, passing almost immediately to brown; with hydrochloric acid it underwent no change of colour. Acetate of lead produced no precipitate in a solution of crocin in the cold, but on warming the solution, decomposition at once took place, and the liquid then reduced Fehling's solution. As previous workers used lead acetate in the separation of crocin, Herr Kayser supposes that their product always contained crocetin. He attributes to pure crocin the formula $C^{44}H^{70}O^{28}$, and to crocetin $C^{34}H^{46}O^{9}$, the decomposition being represented by the following equation:—

$$2\,C^{44}H^{70}O^{28} + 7\,H^{2}O = C^{34}H^{46}O^{9} + 9\,C^{6}H^{12}O^{6}.$$

An ethereal extract of the residual saffron yielded a crystalline bitter substance, freely soluble in water and alcohol, less easily in chloroform and ether, and melting at 75°. This has been named "picrocrocin," and is represented by the formula $C^{38}H^{61}O^{17}$. It presents the interesting character that when warmed in aqueous solution with lead acetate, lime or baryta water or acid, it splits up into sugar and an essential oil, which has a strong odour of saffron and the composition of a terpene.

The following is the mean of two proximate analyses of saffron by G. Laube and Aldendroff, quoted by König:—

Water	16·07	per cent.
Albuminoids	11·74	,,
Fluid oil	·60	,,
Fat	3·22	,,
Sugar	15·33	,,
Non-nitrogenous extractive	44·57	,,
Cellulose	4·37	,,
Ash	4·37	,,

The anhydrous saffron contained nitrogen 2·24 per cent. and oil and fat 4·55 per cent.

Commerce.—Saffron is imported into Bombay from France, and occasionally from China. In 1882-83, the imports were 226 cwts., valued at Rs. 4,25,124; in 1886-87, 268 cwts., valued at Rs. 5,50,383. Most of it is adulterated; a sample examined by Lyon (1875) gave water 9·48, organic matter 56·93, mineral matter (chiefly carb. of lime) 33·59. This adulteration is easily detected by placing a pinch of the saffron in water, when the viscid substance used to make the lime adhere to it dissolves, and the lime falls to the bottom of the glass. Similar adulteration with other heavy powders has been recorded, and vegetable substances, as florets of marigold and safflower, fragments of petals, and fibres of grass and rush, have been found. Pure saffron costs in India Rs. 20 to 22 per lb. Cashmere saffron is exported to the Punjab, where it is much used as a dye, to the value of Rs. 20,000 yearly.

Pardanthus chinensis, *Bot. Mag.* 171, Syn. *Ixia chinensis,* Linn., is the *Balamcanda Schularmani* of Rheede (*Hort. Mal.*, xi., 37), and is a common garden plant in India, having flowers spotted like a leopard's skin. In Cochin-China, China, and the Doons of the Himalayas it grows wild. Loureiro states that the roots are used medicinally in Cochin-China, and that they have aperient and resolvent properties and purify the blood of gross humors, being specially useful in Cynanche. According to Rheede, it is used as an alexipharmic in Malabar, being given to those who have been bitten by the cobra, and to cattle who have fed upon poisonous plants.

AMARYLLIDEÆ.

CURCULIGO ORCHIOIDE, *Gärtn.*

Fig.—*Wight Ic., t.* 2043; *Roxb. Cor. Pl. i., t.* 13; *Bot. Mag., t.* 1076; *Rheede, Hort. Mal. xii., t.* 59.

Hab.—Hotter regions of India and Ceylon. The root.

Vernacular.—Músali, Músali-kand (*Hind., Mar., Guz.*), Nella-tádi (*Tel.*), Nela-pana-kelangu (*Mal.*), Nila-panai-kizhangu (*Tam.*), Tála-muli (*Beng.*), Nela-tạli-gadde (*Can.*), Hín-bin-tal (*Cingh.*).

History, Uses, &c.—Both Hindu and Mahometan medical writers speak of a white and black Músali, which, from their descriptions, appear to have been different varieties of the same plant. In the *Rája Nirghanta* it is stated—मूषली च द्विधा प्रोक्ता श्वेता चापरासंज्ञका श्वेता स्वल्पगुणोपेता अपरा च रसायनी; the plant is described as Hemapushpi, "having golden flowers," and is considered to be alterative, tonic, restorative, and useful in piles, debility and impotence. It enters into the composition of several medicines intended to act as aphrodisiacs and restoratives. At the present time we meet with a white and black Músali in the bazars, but derived from two entirely different plants, viz., the *white* from an Asparagus, and the *black* from a Curculigo. We have been favoured with living specimens of the latter plant collected by Mr. B. B. Nené of Poona at Sitabaldi, and find that when cut and dried it exactly agrees with the bazar article which we have received from most parts of India. From Madras we have received a very small Curculigo root, from *C. brevifolia,* not more than an inch in length, whereas the root of the plant in general use is not less than 6 inches in length, and from ½ to ¾ inch in diameter. Dutt states that Satávari, the root of *Asparagus recemosus,* is sometimes sold by the druggists as white Músali; in Bombay the white Músali of the bazar is the root of *Asparagus adscendens.*

Native medical works give the following instructions for the collection of Músali:—Two-year old plants are to be selected,

and the roots having been washed and cleared of rootlets, are to be sliced with a wooden knife, threaded upon a string, and dried in the shade; when dry they may be powdered. The dose is 180 grains, to be beaten up with an equal quantity of sugar in a small glass of water or milk until it forms a thick mucilage. Treatment to be continued for forty days, abstinence from mental and physical exercise being enjoined. Músalí is prescribed for asthma, piles, jaundice, diarrhœa, colic, and gonorrhœa; it is considered to be demulcent, diuretic, tonic, and aphrodisiac, and is often combined with aromatics and bitters. Hakim Sharafeddín in his *Mujarabát* has the following humorous anecdote in illustration of its restorative effects:—

من شروع بخوردن این دوا نمودم وپدر من جهت آنکه بازن خود مقاربت نه نمایم مرا بریک جانب و زوجهٔ مرا بجانب دیگرخود میخوابانید چون بیست روز ازخوردن این دوا گذاشت از شدت قوت باه و شبق نتوانستم صبرنمود شبی پای خودرا از بالای پدر دراز کرده زن خودرا بران پا سوار نموده بدین طرف آوردم و بااو مقاربت کرده باز برپا سوار نموده بدانجانب فرستادم که دربین پای من لغزش نمود و اندک فرود آمده وپای زن من برشکم پدر رسید ازخواب بیدارشد گفت ای ظالم چرا تاچهل روز صبر نکردي که این لغزش و ضعف هم نمیماند

The story at once suggests to the reader that in such cases چهل روز صبر is probably as good a tonic as Músalí.

Description.—Músalí occurs as short transverse sections of the root, half an inch or less in diameter, covered externally by a dark-brown bark; the substance of the root is opaque and greyish-brown; portions of the characteristic, wrinkled, vermicular rootlets may usually be found attached to some of the pieces. The taste is mucilaginous and slightly bitter.

Microscopic structure.—The fresh root of *C. orchioides* when cut across presents a firm milk-white, opaque surface, marked with numerous minute punctures. Thin sections show that it consists of a cortical and central portion, both composed mainly of a delicate parenchymatous tissue loaded with small starch granules, here and there a large cell contains a bundle of needle-shaped crystals. The large open passages which can be seen

with the naked eye are almost entirely confined to the cortical portion ; they are lined by the walls of the neighbouring cells. In the central column are numerous bundles of spiral vessels which are mostly situated near its junction with the cortical portion. Many of the starch granules are muller-shaped.

Chemical composition.—A proximate analysis of the powdered roots was made with the following results :—

Ether ext. (fat, &c.)	1·28
Alcoholic ext. (resin, tannin)	4·14
Water ext. (mucilage)	19·92
Starch, &c., by difference	43·48
Crude fibre	14·18
Ash	8·60
Moisture	8·40
	100·00

The resin was soluble in spirit and alkaline solutions, and gave a fine red colour with strong sulphuric acid. The tannin gave a green colour with ferric salts, and when determined separately amounted to 4·15 per cent. of the root. Oxalate of calcium was present.

CRINUM ASIATICUM, var. TOXICARIUM, *Herbert.*

Fig.—*Bot. Mag., tt.* 1073, 2908, 2239; *Wight Ic., t.* 2021 ; *Rheede, Hort. Mal. xi., t.* 38; *Bentl. and. Trim., t.* 275.

Hab.—Concan. Cultivated throughout India. The bulb and leaves.

Vernacular.—Chindár, Kánwal, Sukhdarshan (*Hind.*), Nágadavana (*Mar.*), Nágdamani (*Guz.*), Nágdaun (*Beng.*), Kesarchettu, Visha-manjili (*Tel.*), Visha-manjil (*Tam.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit writers on Materia Medica, but the juice of the leaves after they have been slightly roasted is a popular remedy in

Hindustan for earache. The name Sukhdarshan, "pleasant to the sight," is loosely applied to several species of Crinum in most parts of Northern India. In the Concan the leaves smeared with mustard oil or *Mutel** are warmed and bound round inflamed joints. Rheede says:—" Ex planta concisa et tosta bini sunt noduli, qui utrinque maxillæ appositi, spasmum curant cynicum." Ainslie states that the natives of Southern India bruise the leaves and mix them with a little castor oil, so forming an application which they think useful for repelling whitlows and other inflammations that come at the ends of the toes and fingers; also that the juice of the leaves is employed for earache in Upper India. Rumphius, who calls it *Radix toxicaria,* speaks highly of its virtues in curing the disease occasioned by the poisoned arrows of the Macassers in their wars; the root chewed is emetic, provided a little of the juice is swallowed. *Crinum asiaticum* is the *Man-sy-lan* of the Cochin-Chinese, and its virtues are lauded by Loureiro. (*Ainslie, Mat. Ind.,* Vol. II., p. 464.) Sir W. O'Shaughnessy remarks (*Bengal Disp.,* p. 656) that this is the only indigenous and abundant emetic plant, of which he has experience, which acts without producing griping, purging, or other unpleasant symptoms. In the *Pharmacopœia of India,* the root has been made official as an emetic, nauseant, and diaphoretic; directions for making a juice and syrup are given: the former to be given in doses of 2 to 4 fluid drachms every 20 minutes until emesis is produced, the latter in doses of 2 fluid drachms as a nauseant and emetic for children.

Description.—Caulescent or stemless; leaves linear-lanceolate, very smooth; margins entire, striated beneath, 3 to 4 feet long and 5 to 7 inches broad; scapes axillary, shorter than the leaves, a little compressed; flowers numerous, 12 to 50 in an umbel, white, almost inodorous; berries roundish, the size of a pigeon's egg. (*Bomb. Flora,* Pt. I., p. 257.) The root is bulbous, white, with a terminal stoloniferous fusiform portion issuing from the crown of the bulb; it varies greatly in size; odour narcotic and disagreeable.

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* The oil obtained from fresh rasped cocoanuts.

Microscopic structure.—The central portion of the bulb (stoloniferous fusiform portion) consists of a parenchyma made up of polyhedral cells containing a little granular matter and some needle-shaped crystals; it is traversed by numerous bundles of jointed and spiral vessels; surrounding the central portion is a solid cortical layer less vascular than the central column; from both of these spring the subterraneous white bases of the leaves which form the upper part of the bulb.

Crinum zeylanicum, *Linn.*, *Wight Ic.*, 2019—20; *Rheede, Hort. Mal. xi., t.* 39; *Bot. Mag.*, 1171, 2217, 2292, and 2466, is a very variable plant, plentiful in most parts of India. It is the *Tulipa javanica* of Rumphius. Rheede states that the crushed and toasted bulb is applied to piles and abscesses to cause suppuration, and that if given to dogs it causes their teeth to fall out. According to Loureiro, it has the properties of squills. In the Concan a slice of the bulb is used for blistering cattle, and the roasted bulb is used as a rubefacient in rheumatism. The plant is called Sukhdarshan in Bengal and Hindustan, and Gadanikand or Gadámbhikánda in Marathi. It has not been identified with any of the plants mentioned by Sanskrit writers. Its properties are similar to those of *C. asiaticum*.

Description.—Root a spherical, tunicated bulb; leaves numerous, radical, lanceolate, waved, smooth, tapering slowly from within a few inches of the base to rather a broad and obtuse point; margins scabrous with minute cartilaginous teeth, length 1 to 3 feet; scapes from the axils of the decayed leaves, somewhat compressed, 1 to 2 feet long; umbels with about 10 flowers; spathes two, of an ovate conic form, with many soft filaments among the flowers; flowers sessile, large, tube green, border very pale rose, almost white, faintly fragrant; corol tube declinate, cylindric, obscurely 3-sided, about 4 inches long; border campanulate, horizontal, segments lanceolar, with rather soft subulate points; length 3 to 4 inches; filaments six, inserted in the mouth of the tube, declinate; apices sharp and always erect; anthers falcate, incumbent and tremulous, pale yellowish-grey; germ inferior, oblong, 3-celled with several ovula in each,

attached in two vertical rows to the two lobes of the thick fleshy receptacles; style filiform, declinate, projecting beyond the stamina; stigma small, 3-toothed; pericarpium a soft somewhat fleshy perishable envelope which covers one, two, or three large fleshy bulbiform seeds.

LILIACEÆ.

ALOE PERRYI, *Baker.*

Fig.—*Bot. Mag.*, 6596. Socotrine Aloe (*Eng.*).

Hab.—Socotra.

ALOE ABYSSINICA, *Lam.*

Fig.—*Baker in Linn. Journal, xviii.*, 174. Jaferabad Aloe (*Eng.*).

Hab.—Africa, Coasts of India.

ALOE VERA, *Linn.*

Fig.—*Flora Græca.*, *t.* 341, *cop. in Steph. & Ch.*, *t.* 109, and *Woodville*, vol. v.; *Nees*, *t.* 50. Common or Barbadoes Aloe, (*Eng.*).

Hab.—Africa, Arabia, India. The dried juice.

Vernacular.—Ghikunvár, Kumári (*Hind.*), Ghirta-kunvár, Komári (*Beng.*), Kora-kánda, Koraphád (*Mar.*), Kumára, Kuvára (*Guz.*), Shottu-katrázhai, Kumári (*Tam.*), Kalabanda (*Tel.*), Kátruvazha (*Mal.*), Lola-sara (*Can.*).

The drug Aloes.—Ilva, Yalva (*Hind.*), Moshabbar (*Beng.*), Eilya, Kála-bol (*Mar.*), Kariya-polam, Irakta-polam (*Tam.*), Musham-baram (*Tel.*), Chenna-náyakam (*Mal.*), Elio (*Guz.*), Musambra (*Can.*).

History, Uses, &c.—The common Aloe (Grihakanya), if not a native of India, must have run wild in the country from a very remote period, as the Sanskrit synonyms do not in any

way indicate a foreign origin. By the names Ghrita-kumári, Kumári, Mátá, Kanyaka, Taruni, Sávari, the plant is compared to a beautiful girl or to the virgin Durga. Many synonyms are descriptive, such as Dirgha-pattrika "long-leaved," Sthaleruha "growing in dry ground," Mridu "soft," Bahu-pattra "having numerous leaves," Kantaka-pattra "having prickly leaves," Vipula-srava "juicy," Mandalá "scimitar-like," Atipicchila "very slimy," &c. The juice is considered to be cathartic, cold, and useful for removing disease of the spleen, swellings, phlegm, carbuncles, and blood and skin diseases. The Hindus appear not to have been acquainted with the drug until it was introduced into India by the Arabs; when this took place it is very difficult to decide, but it must have been at a very remote period if we are to believe Dioscorides, who says "the Aloe grows plentifully in India, whence also the juice is brought to us, also in Arabia and Asia (minor), and in certain maritime districts and islands, as Andros." On the other hand, Sanskrit writers do not mention the drug; possibly the orthodox Hindu physicians of those days may have regarded it as an impure compound prepared by foreigners. *Elwa* or *Ailwa*, the Hindi name for aloes, appears to be cognate to the Greek ἀλοη. Aloes appears to have been first manufactured by Arabs or Abyssinians, through whom the Greeks obtained a knowledge of it. Hippocrates and Theophrastus do not mention it, but Dioscorides and Pliny were evidently well acquainted with the drug and its uses, and also with the plant, which it appears had been introduced into the Cyclades. Abu Hanifeh in the 9th century describes aloes (Sabir) and the plant from which it is obtained as having a yellow flower and very thick leaves which are crushed and thrown into the presses, and trodden with the feet until their juice flows, when it is left until it thickens, and is then put into leathern bags and exposed to the sun until it dries. This method of preparation fully accounts for the inferiority of Arabian aloes. All the Arabian and Persian writers agree in stating that the best aloes is prepared in Socotra, and many relate that Alexander, on the recommendation of Aristotle, took possession of the island on that account and settled a colony of

Greeks there to cultivate the plant more carefully. Schweinfurth has observed an apparently Semitic type amongst the hill tribes of the island, which he thinks may be traced to a Greek source; characterised by small head, with long nose and thick lips, straight hair, and lean limbs. In some hieroglyphics on the Kadhab plain he has also traced combinations of Greek characters. The Socotrian women are reputed to be sorceresses of the most dangerous kind, who by the aid of a magic cup steal away the liver and lights of those against whom they bear malice; a horrid suggestion to account for the excellence of their aloes. This story seems to support the derivation of the names Socotra and Socotrine suggested by Mr. Mowat in '*Alphita*,' p. 67. He connects them with the Greek συκωτός = Lat. ficatus = It. fegato. This word 'originally seems to have denoted the liver of a goose fattened on figs,' and the word socotrinum or succotrinum applied to aloes would therefore be the equivalent of epaticum. (Cf. *Trans. Rl. Soc. Edinburgh*, xxxi., p. 444.) Burton says: "The aloe, according to Burckhardt, is planted in grave-yards as a lesson of patience: it is also slung, like the dried crocodile, over house-doors to prevent evil spirits entering: 'thus hung without earth and water,' says Lane (*Mod. Egypt*, Chapt. XI.), 'it will live for several years and even blossom. Hence (?) it is called *Sabr*, which signifies patience.' But *Sibr* as well as *Sabr* (a root) means 'long-sufferance.' I hold the practice to be one of the many Inner African superstitions. The wild Gallas to the present day plant aloes on graves, and suppose that when the plant sprouts the deceased has been admitted to the gardens of *Wák*, the Creator." (*Arab. Nights*, i., 138.) Mahometan physicians describe aloes as aperient, deobstruent, depurative, anthelmintic and tonic; as a collyrium they consider that it strengthens the sight and removes styes of the lids; it is often applied for the dispersion of swellings and the promotion of granulations. They direct it to be purified in the following manner:—Take Socotrine Aloes 1 lb., powder and sift, then take wormwood, Jatamási, Chiretta, Cinnamon, Cassia, wood of the Balsam tree, Herba Schœnanthi, Asárum, Mastich, of each 3 dirhems, boil in 2 lbs. of water

down to one pound and strain. Put the aloes into a mortar, rub it down with part of the above decoction and strain, repeat the process with the remainder of the decoction and any aloes remaining on the strainer, let the strained liquors subside, draw off the supernatant fluid, mix the aloes with 3 dirhems of saffron and preserve for use. In Anthony Colin's translation of Clusius, the following notice of aloes by Garcia d'Orta occurs:—"Les Indiens s'en servent en leurs collyres et aux medicamens purgatifs comme aussi és playes, lesquelles ils veulent remplir de chair pour lequel usage ils ont le plus souvent dedans leur boutiques un medicament composé de myrrhe ét aloes apellé par eux Mocebar (mussabar). J'ai vue un medecin du grand Sultan Badur Roy de Cambaya lequel usoit de l'herbe d'aloes pour medicament familier en ceste façon. Il faisoit cuire avec du sel les fueilles de l'herbe couppées, de telle decoction il en faisoit prendre huict onces lesquelles faisoyent vuider le ventre fort benignement et sans aucune extorsion quatre ou cinq fois. En ceste ville de Goa ils donnent en breuvage a ceux qui ont des ulceres aux reins ou en la vescie de l'aloe bien pulverisé et meslé avec du laict qui a si heureux succes et profit que les malades en sont incontinent gueris. Ils s'en servent aux Indes pour faire meurir les flegmons." In the same work there is a prescription for the use of fresh aloe leaves by Christophe de la Coste. Take of aloe leaves sliced 3 ozs., salt 3 drms., heat to boiling over a gentle fire, strain and add 1 oz. of sugar. Let the liquid cool, and take it cold early in the morning. The patient should be directed to keep moving about to promote the action of the medicine, and four hours after taking it some chicken broth may be given. The leaves and flower stalks of the aloe are pickled by Banians of Guzerat after having been soaked in salt and water, and it is a general practice among Hindus to give a little of the juice of the plant with honey in a golden spoon to new-born children; it is supposed to hasten the expulsion of the meconium. The dose must be administered by the father of the child, or by the nearest male relative in the absence of the father.

Prof. Bayley Balfour, who visited Socotra on a botanical expedition in 1880, has given the following account of the manner in which aloes is prepared:—"The gum is known as *tâyef* by the natives. The collector scrapes a slight hollow on the surface of the ground in the vicinity of an aloe plant, into which he depresses the centre of a small portion of goat-skin spread over the ground. The leaves of the aloe are cut and laid in a circle on the skin, with the cut ends projecting over the central hollow. Two or three layers are arranged. The juice, which is of a pale amber colour, with a slight mawkish odour and taste, trickles from the leaves upon the goat-skin. After about three hours the leaves are exhausted; the skin containing the juice is then removed from beneath them, and the juice is transferred to a bag made of skin. Only the older leaves are used. The juice thus collected is of a thin watery character, and is known as *tâyef rhiho*, or watery aloes. In this condition it is exported to Muscat and Arabia, and sells for three dollars the skin of 30 lbs. By keeping, however, the aloes changes in character. After a month the juice, by loss of water, becomes denser and more viscid; it is then known as *tâyef gesheeshah*, and is more valuble, a skin of 30 lbs. fetching five dollars; whilst in about fifteen days more—that is, about six weeks after collection—it gets into a tolerably hard solid mass, and is then *tâyef kasahul*, and is worth seven dollars a skin of 30 lbs. In this last condition it is commonly exported. (*Trans. Rl. Soc. of Edinburgh*, xxxi., *Introductory Chapter*, p. xxxviii.).

Description.—Socotrine aloes is imported into Bombay *viâ* Zanzibar and the Red Sea ports. It is packed in skins, the packages varying much in size and shape, and often containing a large proportion of rubbish, such as pieces of hide, stones, &c. In Bombay the skins are opened, and the aloes repacked in boxes for exportation to Europe. The best Socotrine aloes is of a golden-brown colour, hard externally, soft internally: the odour is aromatic and peculiar; when powdered or in thin fragments it is orange-brown, sometimes it is almost fluid.

Jaferabad Aloes is made at Jaferabad, a town on the coast of Kathiawar, belonging to the Hubshis of Jinjíra, a family of African origin. The drug in mass is black; it has a glassy fracture; thin pieces are yellowish-brown and translucent; the powder is of a dull yellow; the odour powerfully aloetic, with an aroma like Socotrine aloes; when brought in contact with nitric acid it does not turn red. Its reaction is then the same as Socaloin. Jaferabad Aloes is generally in the form of flat circular cakes. From Zanzibar an aloe is imported which very closely resembles Jaferabad; it gives the same reaction with nitric acid.

Yamani or **Moka Aloes,** also called Aden Aloes, is imported from Arabia, and is the kind most in use among the natives of India. It varies much in quality. It is of a black colour in mass, and somewhat porous, but thin fragments are translucent and yellowish-brown; the odour is powerfully aloetic, without the aroma of Socotrine or Jaferabad Aloes; medicinally it appears to be sufficiently active. With nitric acid it gives a deep red colour, like Barbadoes; the solution in sulphuric acid is not affected by nitric acid fumes.

Mysore aloes is made in Mysore from a plant which is probably only a variety of *A. vera*. It is called Musambra in Southern India, and is used in the arts in preparing a false gilding for decorations.

Chemical composition.—All kinds of aloes have an odour of the same character and a bitter disagreeable taste. The odour, which is often not unpleasant, especially in Socotrine Aloes, is due to a volatile oil, which the drug contains only in minute proportion. The oil is a mobile pale yellow liquid, of sp. gr. 0·863, with a boiling point of 266° to 271°C.

" Pure aloes dissolves easily in spirit of wine with the exception of a few flocculi; it is insoluble in chloroform and bisulphide of carbon, as well as in petroleum ether. The specific gravity of fine transparent fragments of aloes, dried at 100°C., and weighed in the last-named fluid at 16°C., has been found to be 1·364, showing that aloes is much more ponderous than most

of the resins, which seldom have a higher specific gravity than 1·00 to 1·10. In water, aloes dissolves completely only when heated. On cooling the aqueous solution, whether concentrated or dilute, becomes turbid by the separations of resinous drops, which unite into a brown mass, the so-called resin of aloes. The clear solution, after separation of this substance, has a slightly acid reaction; it is coloured dark-brown by alkalies, black by ferric chloride, and is precipitated yellowish-grey by neutral lead acetate. Cold water dissolves about half its weight of aloes, forming an acid liquid which exhibits similar reactions. The solution of aloes in potash or ammonia is precipitated by acids, but not by water. (*Pharmacographia*, p. 686.)

The most interesting constituents of aloes are the substances known as *Aloin*. The Aloin of Jafarabad Aloes has been examined by W. A. Shenstone. About 1½ lb. of the powdered aloes was treated with enough proof-spirit to make a thin paste, and after standing for a few hours was enveloped in folds of stout calico and submitted to powerful pressure, by which means about 28 per cent. of crude Aloin was obtained. This was purified by twice crystallizing from water, then by crystallizing several times from dilute spirit, and finally by crystallizing twice or thrice from rectified spirit. Portions of the crops of crystals thus obtained were burnt with the following results:—

I. ·1104 gram of aloin which had been once crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·2438 gram of CO^2 and ·0561 gram of H^2O.

II. ·1380 gram of aloin which had been twice crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·3042 gram of CO^2 and ·0696 gram of H^2O. Corresponding to

	Carbon.	Hydrogen.	Oxygen.
I.	60·22	5·64	34·14
II............	60·11	5·60	34·29

The aloin therefore was evidently in a pure state. 1·2375 gram of pure air-dried aloin dried over sulphuric acid in a vacuum lost ·1987 gram of water, corresponding to 16·0 per cent.

When bromine water was added in excess to an aqueous solution of the aloin, a copious yellow precipitate fell. This was collected after having been in contact with excess of bromine water for an hour, washed, dried, and crystallized three times from spirit. The brominated aloin was in beautiful yellow crystals, which were rather soluble in cold alcohol, and were somewhat more stable than the aloin itself. It retained only a trace of water when dried in a vacuum over sulphuric acid, which was given off on heating to 100° C. to 110° C. ·2526 gram of the perfectly dry substance gave ·2539 gram of silver bromide, corresponding to 42·75 per cent. of bromine.

In 1875, Dr. Tilden proposed, as the result of the consideration of a number of analyses of aloins and their derivatives made by himself and others, that the aloins obtained from Barbadoes and Zanzibar aloes might be considered isomeric bodies, with the empirical formula $C^{16}H^{18}O^{7}$, which also agrees closely with his analysis of nataloin. This formula requires 59·62 per cent. of carbon and 5·59 per cent. of hydrogen. Its tribromo-derivative requires 42·93 per cent. of bromine.

It will be seen that of the numbers obtained in Mr. Shenstone's analysis, those for the hydrogen and bromine agree very closely with these, and that the proportion of carbon, though a little high, also agrees fairly well.

The water of crystallization found, 16 per cent., is rather more than the amount which would correspond to three molecules, *i.e.*, 14·3 per cent. The difficulty of getting air-dried aloin of constant composition, however, is so great that the result is not of much value.

The following comparative observations with Jafarabad aloin and Dr. Tilden's zanaloin were made:—

There is no distinguishable difference in the crystalline form of the two aloins.

Neither of them gives any change of colour in the cold when moistened with ordinary strong nitric acid; both of them are reddened by fuming nitric acid. And the Jafarabad aloin, by

prolonged treatment with nitric acid, yields chrysammic, aloetic, picric, and oxalic acids as zanaloin and barbaloin do.

Jafarabad aloin, when treated with potassium chlorate in a hydrochloric acid solution, yields a chloro-body resembling that given by zanaloin, and when heated with acetic anhydride gives an acetyl compound similar to acetyl-zanaloin.

Both of them, when treated with strong sulphuric acid and potassium bichromate, give a violet coloration closely resembling that given by strychnia, but quickly fading to green.

These results seem to leave no doubt that the aloin of Jafarabad aloes is identical with that from Zanzibar aloes, though the colour of the former is distinctly a lighter shade of yellow than that of the latter.

The main points of difference among the aloins may be tabulated thus:—

1. Nataloin obtained from Natal aloes, yields only picric and oxalic acids by treatment with nitric acid. Is not reddened, even on heating, by that re-agent.

2. Barbaloins yield chrysammic, aloetic, picric, and oxalic acids by treatment with nitric acid. They may be divided into—

(A) *a*-barbaloin, obtained from Barbadoes or Moka aloes. Is reddened in the cold by ordinary strong nitric acid.

(B) *b*-barbaloin, obtained from Socotrine, Zanzibar, and Jafarabad aloes. Is not coloured by cold nitric acid, but gives an orange-red coloration when heated with it, and also gives a coloration in the cold with fuming nitric acid. (*Shenstone in Phar. Journ.*, Dec., 1882.)

Commerce.—Bombay is the centre of the Aloes trade in the East and imports from Arabia (and Socotra through Aden) yearly about 1,500 cwts. of the drug valued at about Rs. 30,000. Of this quantity from 300 to 400 cwts. (chiefly Socotrine) are re-exported to Europe, and 200 to 300 cwts. to Eastern ports, the remainder being consumed in India.

Madras and Sind occasionally export small quantities of Indian aloes to Eastern ports.

The Indian varieties of the drug are manufactured in Kattiawar (Jafarabad) and in Mysore, and are consumed locally. It is impossible to form a correct estimate of the quantity produced, but we do not think it can be very great, as the Arabian aloes is the drug met with in most parts of India.

URGINEA INDICA, *Kunth.*

Fig.—*Wight Io., t.* 2063. Indian Squill (*Eng.*).

Hab.—India. The bulb.

Vernacular.—Kándá, Jangli-piyaj (*Hind., Beng.*), Kol-kándá, Kochinda (*Mar.*), Nari-vengayam (*Tam.*), Nakka-vulli-gadda (*Tel.*), Kattulli (*Mal.*), Adavi-irulli (*Can.*), Jangli-kánda (*Guz.*).

History, Uses, &c.—This plant is not mentioned in the Nighantas, but the bulb is used in the preparation of Chándi-bhasma or "ashes of silver" which is used medicinally by the Hindus. Indian Mahometan writers consider the Indian squill to be identical in medicinal properties with the squill of Europe, which was used by the Greeks, who prescribed it combined with vinegar and honey much as we do at the present time (*Diosc.* ii., 162); they prescribe it in paralytic affections, also as an expectorant, digestive, diuretic, and deobstruent in many diseases, more especially in asthma, dropsy, rheumatism, calculous affections, leprosy, and skin diseases; it is also considered to be emmenagogue. In the West *Urginea Scilla* has been used in medicine from the time of Hippocrates; in Egypt it was sacred to the god Typhon and at Pelusium there was a temple dedicated to it; it was thought to have the power of driving away evil spirits, and to be symbolic of perpetual generation. The Arabs, who followed the Greeks in their estimation of its medicinal value, call it Basal-el-unsal "sea onion," or Basal-el-fár "rat's onion," and the Persians, Piyáz-i-dashti "wild onion." European physicians in India have expressed various opinions as to the medicinal activity of *Urginea indica* (confer. *Phar. of India*, p. 241), but there would appear to be no doubt that the young freshly-dried bulbs are sufficiently active, as they have been

used for many years at certain of the Government Medical Store Depôts for making the various preparations of the drug.

In India the squill is always kept by native druggists in the entire state, this form being preferred by the hakims to the sliced and dried bulb. They follow the Greeks and Romans in their method of baking squills (cf. *Diosc. loc. cit.* and *Scrib. Larg. Comp.* 76).

Description.—*Urginea indica* is very abundant in sandy ground near the sea; the dirty white spike of flowers appears long before the leaves. The bulb is tunicated, consisting of fleshy coats, which enclose each other completely, generally about the size of a common onion; colour white; taste bitter and acrid.

Microscopic structure.—Each scale or modified leaf is made up of polyhedral cells covered on both sides by an epidermis provided with stomata; like a leaf, it has vascular bundles. The cells of the parenchyma are loaded with mucilage, and contain an enormous quantity of needle-shaped crystals and a few large square or oblong prisms. The presence of the former accounts for the itching of the hands experienced by those employed to slice the bulb.

Chemical composition.—The sample dried at 100° C. was examined by Dragendorff's method, with the following results:—

Petroleum ether extract	·036	per cent.
Ether extract........................	·028	„
Absolute alcohol extract.........	·152	„
Aqueous extract	77·30	„
Ash	5·69	„

The petroleum ether extract was a greasy white residue and non-crystalline. The ether extract contained no alkaloidal principle; under the microscope a few imperfect four-side plates were visible.

The alcoholic extract from 9 grams of the anhydrous squills injected into a cat's stomach caused vomiting in 20 minutes, and the passage of a solid stool about an hour after

the injection; no blood in vomit or stool; the cat was not otherwise affected in any way. The aqueous extract consisted chiefly of gum.

The fresh squill in slices distilled with water afforded a distillate possessing an aromatic odour, but in which no appreciable amount of oil was visible. The distillate was agitated with ether; on spontaneous evaporation of the ether, a minute trace of a white greasy residue was left, possessing an aromatic odour—applied to the skin no irritation was induced. We are indebted to Assistant Surgeon C. L. Bose for the above analysis, which was conducted in the Chemical Examiner's Laboratory, Calcutta.

Substitutes for Squills.—The bulbs of different species of Ledebouria (Scilla, *Linn.*) are sold in the Indian bazars under vernacular names which are equivalent to "small squill." *L. hyacinthoides* is said by Ainslie to be used by farriers in Southern India for the relief of strangury and in fevers occurring in horses. (*Mat. Ind.*, i., p. 402.) From Dr. Hové we learn that the bulbs were used in the Colaba Hospital, Bombay, by Mr. Guise, the Surgeon of the island in 1787, instead of squills. For many years they were issued from the Bombay Medical Stores in lieu of squills (*Indian Journ. of Med. Phys. Sci.*, Jan. 18th, 1838, p. 9), but of late years *Urginea indica* has been in use; both appear to be equally satisfactory substitutes for squills.

L. hyacinthoides has a scaly bulb, about the size and shape of a small pear, composed of very smooth and fleshy scales, which are so imbricated that they might be mistaken for entire coats if not carefully examined; the exterior scales are dry and whitey-brown, the interior fleshy and cream-coloured; the odour is nauseous; the taste bitter and acrid.

Bulbs, the size of a large nut, purchased by one of us in the Bombay shops, which we have cultivated, proved to be those of *Ledebouria maculata*, Dalz. The leaves were obovate, glabrous, wedge-shaped, attenuated into the petiole, purple spotted, and never bearing bulbs; scapes bearing a many-flowered raceme

of small asphodel-like flowers having a delicate purplish-blue tinge, and a bloom like that of the Auricula. This plant is very common in the Concan, and comes into blossom in June, immediately after the first fall of rain.

ASPHODELUS FISTULOSUS, *Linn.*

Fig.—*Wight Ic., t.* 2062; *Sibth. Fl. Gr., t.* 335.

Hab.—Northern India, Afghanistan. The seeds.

Vernacular.—Piazi, Bokhat, Binghar-bij (*Punjab, Sind*).

History, Uses, &c.—The plant has a reputation in Sind and the Punjab as a diuretic, and the seeds are sold in the shops; it is very abundant in cultivated ground about Jhelam and in Southern Afghanistan. (Murray.) Sibthorp describes it as common near Athens. In Northern India and Afghanistan it is eaten as a vegetable. Hesiod, who wrote about 800 B. C., when he enjoins temperance and simplicity of living in his "Works and Days," says (ver. 30):—

νήπιοι. ὀυδέ ἴσασιν, ὅσῳ πλέον ἥμισυ παντὸς
οὐδ' ὅσον ἐν μαλάχῃ τε καὶ ἀσφοδέλῳμέγ ὄνειάρ.

How much is the half better than the whole! How great a blessing is there in Mallows and Asphodel! Theophrastus, in his *History of Plants* (vii., 11), tells us that Asphodel roots were eaten by the Greeks, and an Asphodel is described by Dioscorides* as a medicinal plant having diuretic and deobstruent properties when given internally, and being useful as an external application to ulcers and inflamed parts, &c. The Romans called the same plant '*Hastula regia,*' or king's spear, and used it as a remedy for *morbus regius* or *ἴκτερος* (cf. *Hipp. de Morbis,* ii., 35). Arabic and Persian writers on Materia Medica describe an Asphodel with white flowers under the name of Khunsa (خنثى), the same, or a very similar plant, is called

* Diosc., ii., 159. The Anthericon of Theophrastus was probably the Yellow Asphodel. In Western and Southern India *Anthericum tuberosum,* Roxb., is in common use as a vegetable, boiling appears to remove the acrid properties of these plants.

Ashrásh, or Saresh in Persian; Ibn Sina says اصل الخنثى وراالاشراش To this plant they attribute the same properties as Dioscorides does to Asphodel (confer. *Tuhfat-el-muminín*, article خنثي). The root of *Asphodelus bulbosus* under the name of Teinisse is used in the East to prepare mucilage and adulterate salep.

Description.—Annual, stem naked, ramous; leaves erect, linear, cylindric, fistulous, tapering to a point; scape erect, branched; flowers small, white with a brownish line running along the centre; filaments ciliate, contracted; corol 6-partite; stigma capitate; ovary 3-celled.

GLORIOSA SUPERBA, *Linn.*

Fig.—*Bot. Reg.*, *t.* 77; *Wight Ic.*, *t.* 2047; *Rheede, Hort. Mal. vii.*, *t.* 57. Superb Lily (*Eng.*).

Hab.—Throughout India. The tubers.

Vernacular.—Kalihári, Lánguli (*Hind.*), Bisha-lánguli (*Beng.*), Nága-karia, Indai, Kalávi (*Mar.*), Kalaipai-kizhangu (*Tam.*), Kalappa-gadda, Adavi-nábhi (*Tel.*), Rádágári (*Can.*), Khadya-nága, Nágli, Kalalávi (*Guz.*).

History, Uses, &c.—This very ornamental creeper is common on hedges during the rainy season, and its flowers are used by the Hindus in the worship of Siva and the Lingam. It is one of the seven minor poisons of Sanskrit writers, and is described in the *Rája Nirghanta* under the name of Kalikári. The synonyms are numerous; amongst those which are descriptive we may mention Chihna-mukhi "having a spotted mouth," Sukra-pushpika "having splendid flowers," Agni-sikha "having a crest of fire," and Langalika "plough-like," in allusion to the shape of the root.

Other synonyms, such as Garbha-ghátini, Garbha-pátani, Garbha-nud, allude to the use of a paste of the root as an application to the lower part of the abdomen for the purpose of promoting labour pains. In retained placenta a paste of the root is applied to the palms of the hands and soles of the feet,

whilst powdered Nigella seeds and long pepper are given internally with wine. According to the Nighantas, the root is purgative, hot, light, and pungent; it increases the secretion of bile, and is useful in leprosy, piles, colic, boils, and to expel intestinal worms. The starch obtained from the root by washing is given internally in gonorrhœa.

Moodeen Sheriff, who has experimented with the root, states that it is not so poisonous as is generally supposed; he has taken it in small quantities, gradually increasing the dose to 15 grains. There were no bad effects, but on the contrary he found his appetite improved and felt more active and stronger. He has also used it in his practice for many years, and considers it to be a tonic and stomachic in doses of from 5 to 12 grains given three times a day. In the Concan it is given to cattle to expel worms, and in Madras it is believed to be a specific against the bites of poisonous snakes, and the stings of scorpions, and is also used as an external application in parasitical skin affections. Surgeon-Major Thomson states that before being used for these purposes it is cut up into thin slices and soaked in butter-milk and salt for four or five days, and then dried, by which process its poisonous properties are supposed to be removed. He also says that the natives select those roots which are dichotomous and which they suppose to be those of the male plant, whilst single roots, which they suppose to be those of the female plant, are rejected. (*Dict. Econ. Prod. India*, iii., p. 507.)

Description.—Root tuberous, cylindrical or flattened, often 7 to 8 inches in length, and about one inch in diameter; when fully grown it consists of two tubers which unite at a right angle, one being much shorter than the other; at the point of union may be seen, on the upper surface, a circular scar marking the attachment of the stem, and on the under surface immediately beneath it another, to which a tuft of their rootlets is often attached. The tubers are covered with a brown epidermis, except at their points, which are tapering and nearly white; internally they are juicy, white, and farinaceous, and have a

faint acrid odour. The taste is mucilaginous, feebly bitter, and has an acid taste. The starch granules are mostly ovoid, the vascular bundles few, consisting of spiral and jointed vessels. The root is figured by Lyon. (*Med. Juris. for India*, p. 210.)

Chemical composition.—The root has been examined by Warden, who obtained from it two resins, a tannin, and a bitter principle which he has provisionally named *Superbine.* He considers that the bitter principle is closely allied to, if not identical with that of squills. It was found to be very poisonous, 0·047 gram injected into the stomach being sufficient to kill a full-grown cat. (*Ind. Med. Gaz.*, Oct. 1880.)

Toxicology.—Ainslie and others speak of the root as violently poisonous, and it finds a place in the list of Indian poisons published by Chevers. (*Indian Ann. of Med. Sci.*, ii., p. 147.)

Dr. Buttacharjee (*Ind. Med. Gaz.*, 1872, p. 153) reports the following case:—A female, æt. 18, swallowed a quantity of the powdered root. Symptoms of poisoning appeared in half an hour, and were: retching, violent vomiting, spasms and contortions of the body, with fearful racking pain; from time to time there were short intervals of relief, followed by a recurrence of the same symptoms. Death took place in four hours. The *post-mortem* appearances were congestion of the brain and its membranes, with extravasations of blood. The lungs, liver, and kidneys were all deeply congested. The gastric mucous membrane showed signs of inflammation. The peritoneal covering of the fundus of the uterus (unimpregnated) was also found inflamed.

ASPARAGUS RACEMOSUS, *Willd.*

Fig.—*Wight, Ic., t.* 1056.

Hab.—Throughout India.

ASPARAGUS SARMENTOSUS, *Willd.*

Fig.—*Rheede, Hort. Mal. x., t.* 10.

Hab.—Upper India, Concan, and Deccan. The roots.

Vernacular.—Satáwar, Satávari (*Hind., Guz., Mar.*), Satamuli (*Beng.*), Shatávali (*Mal.*), Kilávari (*Tam.*), Shatávari (*Tel.*), Shípari (*Can.*).

History, Uses, &c.—These two plants appear to be the Satávari and Maha-satávari of the Nighantás: among the synonyms of the first, we find Dvipika, Dvipa-satru, Vara-ghantika, Náráyani, and Sata-padi; the synonyms of the second are very similar, amongst them we note Bahu-puttrika, Dagdha, and Bhasma-rohâ. Both plants are considered to be heavy and cold, sweet, demulcent, galactogogue, tonic, and strengthening, and to remove bilious and rheumatic humors, blood diseases, and swellings; they are used both internally and in the preparation of several medicated oils. The tubers are candied and eaten as a sweetmeat. The fresh juice of the root is given with honey as a demulcent in bilious dyspepsia or diarrhœa (*Sárangadhara*). As an aphrodisiac, Chakradatta directs four *sérs* of the juice of the roots and four *sérs* of *ghi* to be boiled in forty *sérs* of milk, and to be flavoured with sugar or honey, and long pepper.

The chief use of the drug, however, is in the preparation of medicated oils for external application in nervous and rheumatic affections and urinary disorders. The *Náráyana taila,* a popular remedy of this kind, contains the barks of *Ægle Marmelos, Premna integrifolia, Oroxylum indicum, Erythrina indica, Stereospermum suaveolens*, and *Pæderia fœtida;* the roots of *Withania somnifera* and *Boerhaavia repens,* the fruit of *Tribulus terrestris,* and the leaves of *Solanum xanthocarpum, Solanum indicum, Sida cordifolia* and *Sida rhombifolia,* of each twenty tolas. The whole collection is boiled in 64 *sérs* of water down to one-fourth and strained. To the strained decoction is added four *sérs* each of the juice of Satávari and

prepared sesamum oil, sixteen *sérs* of cows' or goats'milk, and a paste prepared with four tolas of each of the following drugs—Fennel seeds, wood of *Cedrus Deodara*, root of *Nardostachys Jatamansi*, liquid storax, Acorus root, sandalwood, herb of *Limnanthemum cristatum*, costus, cardamoms, leaves of *Desmodium gangeticum*, of *Uraria lagopoides*, of *Phaseolus trilobus*, and of *Teramnus labialis*, roots of *Withania somnifera*, *Vanda Roxburghii*, and *Boerhaavia repens*, rock salt. The whole is then reboiled and perfumed. (*Chakradatta.*)

Description.—Both plants are scandent woody shrubs, the roots of which consist of numerous fusiform, smooth, perennial tubers, 6 to 8 inches long and ½ inch in diameter. They have a light brown, silicious external covering which is removed before they are used. The substance of the fresh tubers is mucilaginous, white, and somewhat translucent, and has a mawkish, insipid flavour.

Chemical composition.—The powdered roots were separated into—

Water extract	52·43
Crude fibre	33·65
Moisture	9·46
Ash	4·46
	100·00

The amount of saccharine matter, estimated as glucose, in the water extract was 7·14 per cent. Some of this extract was boiled and filtered and evaporated down to a soft consistence and allowed to remain for three months under a bell jar. At the end of that time no crystalline substances had formed, indicating the probable absence of crystalline sugars, mannite, and asparagin.

Asparagus adscendens, *Roxb.*, is an herbaceous, erect, thorny plant growing in Rohilkhand, Guzerat, and other parts

of Central India. Though not mentioned in the Nighantás, the tuberous root, decorticated and dried, is in general use in India under the names of Suffed-músli, Dholi-musali, or Ujli-músali. The commercial article consists of shrivelled decorticated tubers, from 2 to 2½ inches long, the largest being about ¼ inch in diameter; they are of an ivory white colour, often twisted, hard and brittle; adhering to some of the pieces may be seen portions of a yellowish epidermis; when soaked in water they swell up and become spindle-shaped, the thickest part being about the size of a lead pencil. Under the microscope these tubers present a delicate cellular structure, the cells of which contain nothing but a little fine granular matter and mucilage; this surrounds a central vascular column, the middle part of which is entirely occupied by jointed vessels, the outer portions consisting of scalariform; the portions of adherent epidermis already mentioned are silicious. Suffed-músli has an agreeable mucilaginous taste; we have used it largely as an article of diet; it is far nicer than Salep, and is generally relished by Europeans. To prepare it, take 200 grs. of the powder, 200 grs. of sugar, pour upon them slowly a large teacupful of boiling milk, stirring constantly all the time. The best white picked roots are worth Rs. 25 per maund of 37½ lbs.

Chemical composition.—The powdered roots were examined as those of the previous article, and were found to contain—

Water extract	77·55
Cellulose	12·85
Moisture	6·00
Ash	3·60
	100·00

The water extract was a thick mucilaginous liquid which threw out white flocks of albuminous matter when boiled, and was not affected by Fehling's solution. The portion of the root insoluble in water consisted of almost pure cellulose.

ASPARAGUS OFFICINALIS, *Linn.*

Fig.—*Eng. Bot.*, 339; *Blackw.*, *t.* 332; Sperage, Asparagus (*Eng.*), Asperge (*Fr.*).

Hab.—Europe, Southern Russia, Turkey. Cultivated in Persia and Northern India. The plant, root, and ripe fruit.

Vernacular.—The fruit, Haliyun (*Ind. Basars*).

History, Uses, &c.—Asparagus was well known to the Greeks and Romans both wild and in a cultivated state. Hippocrates mentions it in his treatise on diet, and in his treatise on the Diseases of Women he says that the berries taken in wine promote conception. Dioscorides and Pliny describe its medicinal properties, and Cato (*De re Rust.* c. 161) gives full directions concerning its cultivation. The ancients considered it to be a wholesome vegetable, dispelling flatulency and acting as a mild aperient, diuretic and aphrodisiac. They administered the root in wine for calculous affections and pains in the uterus, and also considered it beneficial in elephantiasis. Ibn Sina calls it هليون *haliún* and quotes Galen's opinion of its medicinal value.

The Western Arabs call it *Isferáj*; in Persia it is known as *Márchubeh* and *Márgiyeh* "snake wort," from its being considered to be an antidote for snake poison. Wild asparagus, the *A. tenuifolius* of Linnæus, was known to the Romans as Corruda, a name still current in the south of France, where the plant is valued for its medicinal properties up to the present time. Broussais considered asparagus to be a sedative in palpitation of the heart, and it is still used in France as a diuretic in cardiac dropsy and chronic gout. The young shoots when eaten as a vegetable are well known to communicate a peculiar and offensive odour to the urine, a syrup for medicinal use is prepared with their juice, 100 parts after clarification being added to 190 parts of sugar.

Some physicians consider asparagus to be useless as a diuretic and even injurious to the bladder, but as far as our experience goes it has no ill-effects when taken daily for a considerable time. Indian Mahometan writers on medicine merely retail

what the ancients have said about this plant; they usually prescribe the dried berries which are to be found in the bazars of all large towns.

Description.—The root consists of a short horizontal rhizome about $\frac{3}{4}$ of an inch thick, the upper side is scaly and marked by stem-scars, below it gives off numerous long, whitish, nearly simple roots, which on drying become much wrinkled. It has hardly any odour and a mawkish sweet taste. The berries are scarlet, about the size of a pea, 3-celled, one or two of the cells often abortive, seeds 1-2 in each cell, globose, with a horny albumen, and a transverse embryo, far out of the centre.

Chemical composition.—Examined by Dulong, the root was found to contain yellow resin, sugar, gum, albumin, chlorides, phosphates, malates, and acetates. Vanquelin and Robiquet (1805) discovered *asparagin* in the shoots, a substance which has since been found in many other plants. Reinsch (1870) found in the berries much grape sugar and *spargancin*, an orange-red sublimable colouring matter soluble in ether and crystallizing in scales. The seeds contain a fixed oil, an aromatic resin, crystallizable sugar, and a crystalline bitter principle, *spargin*. Asparagin, $C^4H^8N^2O^3H^2O$, forms colourless, inodorous, and nearly tasteless crystals, which are insoluble in strong alcohol and ether. It unites with both acids and alkalies, and when boiled with them is converted into *aspartic acid*, $C^4H^7NO^4$, and ammonia. Nitrous acid converts it into malic acid, $C^4H^6O^4$, water and nitrogen. For further information concerning Asparagin, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., I., 325.

The mean of four analyses quoted by König gives the following as the proximate composition:—

Water	93·75	per cent.
Albuminoids	1·79	,,
Fat	·25	,,
Sugar	·37	,,
Nitrogen free extractive	2·26	,,
Cellulose	1·04	,,
Ash	·54	,,

The anhydrous plant contained 4·61 per cent. nitrogen, and 42·08 per cent. carbohydrates.

ALLIUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim.*, 280; *Woodville, t.* 256; *Reich. Ic. Fl. Germ. x., t.* 488. Garlic (*Eng.*), Ail (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The bulbs.

Vernacular.—Lasan, Lahsan (*Hind.*), Rasun, Lashun (*Beng.*), Vallai-pūndu (*Tam.*), Vellulli (*Tel.*), Beliuli (*Can.*), Lasuna (*Mar.*, *Guz.*).

History, Uses, &c.—Garlic is used as a condiment and medicine by the Hindus. In the *Raja Nirghanta* it is described under the name of Rasona, and bears many synonyms indicative of its properties, such as Ugra-gandha "strong smelling," Mahanshadha "panacea," Bhuta-ghna "destroying demons," Lasuna, &c. The Hindus consider it to be tonic, hot, digestive, aperient, cholagogue, and alterative; useful in cough and phlegmatic affections, fever, swellings, gonorrhœa, piles, leprosy, colic, rheumatism, and worms. During its use the diet should consist of wine, meat, and acids. A decoction of garlic in milk is given in small doses in hysteria, flatulence, sciatica, and heart disease. A compound garlic powder called *Svalparasona pinda*, which contains garlic, asafœtida, cumin, rock salt, sonchal salt, ginger, long pepper, and black pepper in equal proportions, is given in doses of about twenty grains every morning with a decoction of the root of the castor oil plant, in facial paralysis, hemiplegia, sciatica, paraplegia, and convulsive affections. Garlic juice is applied externally as a counter-irritant. As a condiment, the bulbs are largely used in the East. Garlic is the σκόροδον of the Greeks and Allium of the Romans, who appear to have used three kinds, *A. sativum*, Linn., *A. oleraceum*, Linn., and *A. ursinum*, Linn. It would be tedious to recapitulate all the medicinal properties ascribed to these plants by the ancients, as they hardly differ from those accorded to

garlic by the Hindu physicians. A summary of them may be found in Pliny (xx., 23). Garlic is the ثوم (thúm) of the Arabians and سير (sír) of the Persians; their medical writers follow the ancients in mentioning three kinds, *viz.*, Bustání "garden," Bari "wild," and Kiráthi "leek-like," and in the account they give of its medicinal properties. The leek-like garlic is probably meant for the bulbed leek (*Porrum capitatum*) of Hippocrates (*De Morb. Mul.*, ii., 89) which was considered to have the property of opening the uterus when contracted, and De Gubernatis states that in Sicily garlic is still placed upon the beds of parturient women. He also notices the wide-spread belief in the protective power of garlic against evil influences among the Hindus, Scandinavians, Greeks, and Germans, as shown by passages in Sanskrit works, in the Songs of Sigurdrifa and Helgi, the Volsungasaga and Hippocrates. In Bologna, at the present day, it is purchased by every one on the feast of Saint John as a guarantee against poverty during the year, whence the proverb:

Chi 'n compra i ai al de d'San Zvan,
É povret tot gl'an. (*Myth. des Plant.*, ii., 7.)

Garlic is still used medicinally to some extent on the Continent of Europe and in America, but in England it is hardly ever prescribed. A syrup of garlic was formerly official in the Dublin Pharmacopœia, and was given in doses of two drachms in moist asthma. As a condiment, it enters into the composition of most sauces. After intense fatigue a clove of garlic slowly chewed, and swallowed, acts as a very powerful restorative.

Description.—Garlic is a sub-globular compound bulb, surrounded by a few dry membranaceous scales, which cover the remnant of the upright stem and the 5 to 8 small bulbs or cloves arranged in a circle around its base. These bulblets are oblong in outline, compressed from both sides, wedge-shaped toward the stem, and rounded upon the back. They consist of a few thick fleshy scales and a short fleshy axis. Garlic has a peculiar pungent and disagreeable odour, and an acrid, burning taste. It is used in the fresh state only.

Chemical composition.—Besides cellular tissue, garlic contains between 50 and 60 per cent. of water, 35 per cent. of mucilage, some albumen, sugar, starch, and about ¼ per cent. of volatile oil, to which its odour and taste are due. W. Dahlen gives the following as the percentage proximate composition:—

Water	64·66
Albuminoids	6·76
Fat	·06
Sugar	trace.
Nitrogen free extractive	26·31
Cellulose	·77
Ash	1·44

Anhydrous garlic contained nitrogen 3·06 per cent. and carbohydrates 74·45 per cent. (*Landw. Jahrbücher*, 1874.)

In its crude state *oil of garlic* is of a dark brown-yellow colour, heavier than water, of a very repulsive taste, and consists of oxide and sulphides of allyl. The rectified oil consists mainly of the sulphide, $(C^3H^5)^2S$, is colourless, lighter than water, and may be obtained artificially by treating an alcoholic solution of potassium sulphide with allyl iodide. It dissolves easily in alcohol and ether, and sparingly in water; with nitrate of silver, mercuric chloride, and other metallic salts it forms crystalline compounds. Garlic, macerated in water or vinegar, yields its virtues to these liquids. (*Stillé and Maisch.*)

Allylic sulphide can also be obtained from the herb and seeds of *Thlaspi arvense*, together with sulphocyanide of allyl, and oil of mustard. The leaves of *Sisymbrium Alliaria* yield oil of garlic, and the seeds oil of mustard. A mixture of these two oils is also yielded by *Capsella Bursa-pastoris, Raphanus Raphanistrum,* and *Nasturtium.* In some cases the oils do not exist ready formed; for example, the seeds of *Thlaspi arvense* emit no odour when bruised, and they must be macerated in water some time before distillation. (*Watts.*)

Commerce.—Garlic is cultivated all over India, and is on sale in every grocer's shop. No statistics are available as to the

quantity produced in India, which must be very large. Value, about Rs. 8 per cwt.

ALLIUM MACLEANI, *Baker.*

Fig.—*Bot. Mag.*, 6707; *Hanbury, Sci. Papers*, p. 156—57.

Royal Salep (*Eng.*).

Hab.—Persia, abundant in the Badghis. The bulbs scalded and dried.

Vernacular.—Bádshah or Pádshah Sálab (*Ind. Bazars*).

History, Uses, &c.—This bulb appears to be the second kind of Sálab mentioned by Mir Muhamad Husain in the *Makhzan*, which he describes as black and shining. It is brought to India by Afghans in small parcels along with the dried fruit and other articles for which they find a sale in the Indian Bazars. A solitary specimen of the dried bulb was sent to Hanbury by Dr. J. E. Stocks, but did not at the time attract attention. In 1858, however, a parcel containing about 100 lbs. having been offered for sale in the London market, Hanbury recognised the drug as identical with the bulb he had received from Dr. Stocks as *Badshah Saleb*, and described it in the *N. Repert. f. Pharm.*, vii., 271. In India the drug is regarded as a kind of salep, and is used as such, but, as Hanbury remarks, its bitterish somewhat acrid taste quite unfits it as a substitute for salep in Europe. The botanical source of the drug was discovered by Dr. Aitchison in 1888.

Description.—Royal salep consists of dried bulbs whose dimensions from base to apex vary from 1¼ to 2 inches. The largest specimens weigh 730 grains: the average weight, taking twenty bulbs, was found to be 337 grains. Allowing for considerable irregularity occasioned by drying, the form of the dried bulbs may be described as usually nearly spherical, sometimes ovoid or nearly oblong, always pointed at the upper extremity, and having at the lower either a depressed cicatrix, or frequently a large, white, elevated, scar-like mark. Their

surface is striated longitudinally, besides which there is mostly one broad and deep furrow running in the same direction. They are usually translucent, and from yellowish-brown to deep purple in colour. In substance the bulbs are dense and horny. After several hours' maceration in water, they become soft, opaque, and of a slaty or purplish hue, and increase greatly in volume, regaining their natural size and form. If, in this state, a bulb be cut longitudinally into two equal portions, it will be seen to consist of a single fleshy envelope or scale of excessive thickness whose edges overlap each other; this scale surrounding an elongated, flattened bud. (*Hanbury.*)

Chemical composition.—The powdered bulbs, unless kept in well-stoppered bottles, readily absorb moisture from the air. A decoction is not coloured with iodine, but is precipitated with solutions of ferric chloride and plumbic acetate. No reaction for glucose is produced by boiling with Fehling's solution. The ash contained manganese. The powdered bulbs afforded moisture 8·11 per cent., mucilage (water extract) 80·80, cellulose 7·14, and mineral matter 3·95 per cent.

Allium xiphopetalum, *Aitch. et. Baker, Trans. Linn. Soc. 2nd Ser. Botany,* Vol. III., Pt. 1, pl. xlviii., yields the Thúm-el-bari or "wild garlic" of the Arabs. It has a bulb resembling Badshah Salep in shape and appearance, but much smaller, a powerful garlic odour, and is much used for pickling by the natives. Large quantities are imported. It appears to have been sometimes confounded with Badshah Salep.

In Persia it is known as Sír-i-piazak or "onion garlic." Aitchison found it growing abundantly in the Badghis. In Bombay it is best known as Muscat garlic, from its being shipped from that port.

Allium ascalonicum, the Shallot, is called by the natives *Ek-kánda-lasun* or *Ekla-kali-lasan,* "one-clove garlic," and is used by them to cure earache, a small piece being placed in the meatus. It is also fried in butter and preserved in honey as an aphrodisiac.

Polianthes tuberosa, *Linn., Bot. Mag., t.* 1817; *Bot. Reg., t.* 63—*Vern.* Gulshabbo, Gulchérí (*Hind., Bomb.*), Raja nígandha (*Beng.*), is the Tuberose of the English, the *Fulla-pipa* of the Portuguese, and the *Amica nocturna* of Rumphius (*Amb.*, v., t. 98); it is a common garden flower, considered by the natives to be hot and dry, diuretic, and emetic. The bulbs are used as a remedy for gonorrhœa. In the Concan they are rubbed with turmeric and butter and applied to remove वत्या (Watiya), small red pimples which often trouble new-born children. They are also rubbed into a paste with the juice of Durva grass (*Cynodon dactylon*) and applied to buboes. The flower is much valued on account of its perfume, for which it is cultivated in France; it sometimes emits phosphorescent flashes of light in the night.

SANSEVIERA ZEYLANICA, *Willd.*

Fig.—*Roxb. Cor. Pl. ii., t.* 184; *Bot. Reg., t.* 160; *Rheede, Hort. Mal. xi., t.* 42. Bowstring Hemp (*Eng.*).

Hab.—Indian Peninsula. The leaves and root.

Vernacular.—Murahri, Marúl (*Hind.*), Murba, Goráchakra (*Beng.*), Márúl-kálang (*Tam.*), Isháma-koda-nár (*Tel.*), Ghan-asphan, Morvel (*Mar.*), Katu-kapel (*Mal.*), Heggurutiké (*Can.*), Murvel (*Guz.*).

History, Uses, &c.—This plant is the Múrvá of Sanskrit writers; it is mentioned by Manu (ii., 42, 44) as the source of the fibre from which the bowstrings and girdle (*maurvi*) of the Kshatriya or warrior caste of Hindus was made. In the *Uttaracharitra* the young prince Lava is represented as wearing a garland of *Múrvá* as symbolical of his position of warrior and penitent. In the Nighantás it bears numerous synonyms, such as Dévi "goddess," Moratá, Madhurasa, Madhusrava "having a sweet juice," Snighda-parni "having glossy leaves," Prithak-parni "diverse-leafed," Pílu-parni, &c., and is described as purgative, heavy, sweet, pungent, tonic, and cardiacal; a remedy for bile, heat of blood, gonorrhœa, *tridosha* (a corruption

of the three humors), thirst, heart disease, itch, leprosy, fever, rheumatism, and glandular enlargements. Rheede gives the following account of its medicinel uses in Malabar:—"Folia trita et in formam boli redacta, adversus opthalmiam et oculorum suffusionem assumuntur: cum radice addito Allio ac Auripigmento in oleo *Sergelim* decocta, gonorrhæam sanant, si nempe caput cum oleo illo illinatur. Bulbus cum Sandalo citrino et butyro bubulino tritus linimentum exhibet, in nervorum contractionibus et ardoribus adhibendum. Tota denique planta oleo butyroque incocta omnium acculorum vitia emendat."

Ainslie (*Mat. Ind.*, ii., 192) remarks:—"This fleshy creeping root is, in a slight degree, warm to the taste, and of a not unpleasant odour; and is prescribed, by the native practitioners, in the form of an electuary, in consumptive complaints and coughs of long standing, to the quantity of a small teaspoonful twice daily. The juice of the tender shoots of the plants they administer to children to clear their throats of viscid phlegm. The plant is cultivated in great abundance at Cumbum, and on the Vursenand Mountains in the Dindigul District."

Description.—Root perennial, stoloniferous. Stolones as thick as the little finger, running under the ground, inserted in sheathing scales. Stem none. Leaves radical, from four to eight, the exterior ones shortest, spreading most, and considerably broader, the interior ones nearly erect, from 1—4 feet long, semi-cylindric, grooved on the upper side, each ending in a round, tapering, sharp point; they are all coloured with deeper and lighter green, and somewhat striated, but otherwise are smooth. Scapes issuing from the centre of the leaves, from 1—2 feet long, including the raceme, or flower-bearing part, erect, round, smooth, about as thick as a small ratan, between the raceme and the base these are at regular distances, four or five pointed, alternate sheaths. Racemes erect, about as long as, or longer than, the scape below the flowers, striated, smooth. Flowers middle-sized, greenish-white, erect, collected in fascicles of from 4 to 6, on little, regularly distant tuberosities of the rachis. Bracts small, membranaceous. Pedicels clubbed, short, ascending, one-flowered. Calyx none. Coralla one-petalled,

not in the least wrinkled, funnel-shaped, half six-cleft; divisions nearly linear. Filaments length of the divisions of the coralla, and inserted into the base. Anthers linear-oblong, incumbent, half two-cleft. Germ 3-lobed, 3-celled, each containing a single ovule, attached to the axis. Style length of the stamens. Stigma 3-sided, clubbed, entire. Berries 1—3, slightly united; when single, globular, fleshy, orange-coloured, smooth, the size of a pea, one-seeded. Seed globubar. Embryo simple, lodged near the base of the perisperm on the outside. (*Roxburgh.*)

Chemical composition.—An alcoholic extract from the fresh roots was mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, ether, then rendered alkaline and reagitated with ether.

The petroleum ether left on spontaneous evaporation a viscid, slightly greenish-yellow residue, with a ginger-like odour, similar to that of the fresh roots. The extract was partly soluble in absolute alcohol, the solution possessing a pungent ginger-like taste and acid reaction. The portion insoluble in alcohol was white and had the properties of a wax.

The acid ether extract had a fragrant vanilla-like odour and was yellowish-green. It contained salicylic acid, a yellow neutral bitter resin, a greenish acid resin, traces of an alkaloid, and a white neutral principle, slightly soluble in cold absolute alcohol: the nature of this principle was not ascertained. The alkaline ether extract contained a crystallizable white alkaloid, affording a slight yellowish-red colour with Fröhde's reagent in the cold, changing to blue on warming; and, with nitric acid, a faint yellow coloration. We provisionally name this alkaloid *Sansevierine.*

HERMODACTYLUS.

Vernacular.—Surinján (*Ind. Bazars*).

History, Uses, &c.—The Hermodactyl, or "Finger of Hermes," was unknown to the early Greeks; it appears to have been first used medicinally by the Arabs or later Greek

physicians; it is first mentioned by Alexander of Tralles, who flourished A.D. 560. (Lib. XI.) It is deserving of special notice that under the name of Surugen or Hermodactyl, Serapion comprehends the κολχικον and εφημερον of Dioscorides and the ερμοδακτυλος of Paulus Ægineta.* (*Pereira*, Vol. II., Pt. I., p. 166.) Masih and other early Arabian writers describe three kinds of Hermodactyl, the white, yellow, and black; in this they are followed by most of the more recent Mahometan writers. According to Ibn Sina, the flower of the Surinján is the first flower which appears in spring in the moist valleys beneath the mountains; the leaves, he says, lie flat upon the ground, the flowers are yellow and white. Mír Muhammad Husain states in the *Makhzan* that the white is the best, and that it is not bitter; next the yellow; both may be used internally; the black, he says, is poisonous and only to be used externally. He describes the Hermodactyl plant as having leaves like a leek and a yellow flower; it is called in Persia *Shambalid;* the black variety, he says, has red flowers.

Aitchison states that the corms of *Merendera persica* (Boiss.), a plant with pale pink or white flowers, are sold at Meshed as *Shambalid,* and are one of the kinds of Hermodactyl; they may occasionally be mixed with those of *Colchicum speciosum* (Stev.), also a common plant in the Badghis and Khorasan. The Kashmir Hermodactyls (Surinján-i-talk) are, he says, undoubtedly the corms of *Colchicum luteum* (Baker). Mahometan physicians consider the drug to be deobstruent, alterative, and aperient, especially useful in gout, rheumatism, liver, and spleen. In gout they combine it with aloes: with ginger and pepper it is lauded as an aphrodisiac; a paste made of the bitter kind with saffron and eggs is applied to rheumatic and other swellings; the powdered root is sprinkled on wounds to promote cicatrization. Two kinds of Surinján are met with in Indian shops, *bitter* and *sweet.* European physicians in India who have tried the drug consider the sweet Hermodactyl to be inert or nearly so, and the bitter to have properties similar to Colchicum. (*Phar. of India*, p. 246.)

* Conf. Dios. iv., 82, 83. Paulus Æ. iii., 78.

Description.—Súrinján-i-shírín, or tasteless Hermodactyl. Speaking of this drug as furnished to him from India by Dr. Royle, Pereira says:—"In their general form these corms resemble those of *Colchicum autumnale.* They are flattened, cordate, hollowed out or grooved on one side, convex on the other. At their lower part (forming the base of the heart) is a mark or disc for the insertion of the root fibres. Their size varies; the specimens I have examined were from ¾ to 1½ inch in length or height, 1 to 1½ inch in breadth, and about ½ an inch in depth. They have been deprived of their coats, are externally dirty yellow or brownish, internally white, easily broken, farinaceous, opaque, odourless, tasteless, or nearly so, and worm-eaten. They agree precisely with Hermodactyls furnished by Professor Guibourt."

"Súrinján-i-talkh, or bitter Hermodactyl. The corms of this variety are distinguished from the preceding by their bitter taste, their smaller size, and by having externally a striped or reticulated appearance. Their colour for the most part is darker; in some specimens it is blackish. One corm is ovate cordate, one inch in height or length, ¾ of an inch broad, and about ¼ inch thick, grooved or hollowed on one side, convex on the other; of a brownish-yellow colour, semi-transparent, has a horny appearance, and is marked by longitudinal stripes, indicating a laminated structure. A second is opaque, amylaceous, reticulated externally, white internally, less flattened and of a remarkable shape, the concave or hollow side of the corm being continued half an inch below the mark for the attachment of the root fibres." (*Mat. Med.*, Vol. II., Pt. I., p. 167.) Pereira's description agrees exactly with the Hermodactyls which we have examined.

Microscopic structure.—The starch grains of the tasteless Hermodactyl are large and muller-shaped, with a distinct hilum. The starch of the bitter kind is angular by compression of the cells, and appears to be broken as if by heat.

Chemical composition.—Lecanu has analysed the tasteless variety, and obtained the following result:—Starch (forming the

bulk of the drug), fatty matter, yellow colouring matter, gum, supermalates of lime and potash, and chloride of potassium.

We have made comparative analyses of the Bitter Surinjan from Lahore and the Sweet Surinjan (*Merendera persica*).

	Bitter.	Sweet.
Ether extract	1·31	·69
Alcoholic extract	·54	6·23
Water extract	12·56	12·52
Starch	65·00	65·90
Cellulose	8·64	3·56
Ash	2·20	2·15
Moisture	9·75	8·95

The ether extract of the bitter Surinjan contained a resin giving a rose-red colour with sulphuric acid. The ether extract of the sweet kind consisted of fat. Both drugs contained an alkaloid giving precipitates with tannin and the usual reagents, and both contained an organic acid related to malic acid. A much larger quantity of Fehling reducing principle was present in the sweet than in the bitter drug, and this is shown in comparing the amounts of extract dissolved out by alcohol.

Commerce.—Bitter Hermodactyls are imported into India from Kashmir. The sweet kind comes from Persia. Value, Re. 1-4-0 per lb.

Substitute for the Bitter Hermodactyl.—The sliced bulb of *Narcissus Tazetta* (the true Narcissus), a plant which, when in bloom, covers like a white carpet great portions of the plains of Behbehám and valley of Sha'b-bawan in Persia, is imported into India as bitter Hermodactyl.

It may be at once detected by its larger size and tunicated structure. The taste is bitter and acrid, the substance amylaceous and very similar to that of the Hermodactyl. The starch grains are rounded and not compressed. It is used as an external application, and, according to the author of the *Makhzan*, has properties very similiar to those of Súrinjan-i-talkh. The several species of Narcissus (Gr. νάρκισσος)

have a similar action. Pliny describes their emetic, purgative, maturative, and drying powers, and, referring to their soporific virtue, says, "et a narce narcissum dictum non a fabuloso puero." The Arabs give a similar account of them. Orfila's experiments upon dogs show that they act as local irritants, and also exert a depressant and paralysing effect upon the brain and whole nervous system. In man small doses are emetic; recently from 15 to 30 grains of the flowers of the common daffodil have been recommended as an emetic for children.

The following is an analyses of the corms of *Narcissus Tazetta* :—

Ether extract	·39
Alcoholic extract	1·02
Water extract	10·24
Starch	71·86
Cellulose	3·84
Ash	1·90
Moisture	10·75

The ether extract was fragrant and greasy. The alcoholic extract contained an alkaloid, bitter and acrid in taste, and a resin. Malic acid was present.

HIRANYA-TUTTHA.

This substance bears a Sanskrit name हिरण्य तुत्थ "golden collyrium," which, in the vernaculars, is converted into Haran-tuttha or Haran-tutiya. It is a medicine of great repute in Afghanistan and Northern India, and is a dark-brown dry extract, sold in small pieces, which is prepared from the corms of *Colchicum luteum* (Baker), and possibly from other species of Colchicum. In Sanskrit Tuttham or Tutthánjana is a term applied to collyria made of sulphate of copper or of the root of a plant with a yellow flower, which has by some been supposed

to be a Curcuma, but which is undoubtedly *Colchicum luteum*, a plant found in the Punjab, Afghanistan, and Kashmir. C. Masson, in his narrative of an Excursion into the Hazareh Country in 1832 (*Trans. Bombay Geograph. Soc.* ii., p. 60), notices a small bulbous root, which the Afghans dug up at Bád Assiar on the banks of the Helmund, and which appeared to be a kind of Colchicum, for the purpose of preparing *Haran-tutika*, a medicine of great repute among the Afghans. He also remarks :—"It is sold in small pieces of a dark-brown colour, and resembles a dry extract." Masson travelled through a great part of Afghanistan on foot, mixing with all classes of the people, and his experience of their manners and customs is very interesting.

SMILAX CHINA, *Linn.*

Fig.—*Kæmpfer Amœn.*, *t.* 782. China root (*Eng.*), Squine (*Fr.*).

Hab.—China.

SMILAX GLABRA, *Roxb.*

Fig.—*Seeman, Bot. of the Herald, tt.* 99—100.

Hab.—Sylhet, Garrow Hills, S. China. The tuberous roots.

Vernacular.—Chob-chini (*Ind. Bazars*), Too-fuh (*Chin.*), Sankira (*Japan*), Cay-khuc-khac (*Coch.-Chin.*), Paringai-puttai (*Tam.*), China-pagu (*Mal.*).

History, Uses, &c.—This drug was introduced into Goa from China about A.D. 1535 (*Garcia*). Previous to this date it is not noticed by any of the Mahometan physicians. The Portuguese, however, appear to have lost no time in carrying it to their factories in Persia, as it was mentioned, a few years after its introduction into Goa, by Mir Imad-ed-din Mahmud of Shiraz, Mirza Kázi of Yezd, and Mir Muhammad Háshim of Teheran. In 1669 it was described as a well-known drug in the *Tuhfat-el-muminin* under the name of Chúb-chini

(Chinese wood), in Arabic Khashab-es-sini. The author of the *Makhzan-el-Adwiya* has a long article upon its medicinal virtues. He also notices particularly the variable appearance of different samples of the drug, and directs that what is heavy, of a rosy colour, and free from knots is to be selected. He tells us that the fresh root is sometimes brought to India; some of this he planted at Moorshedabad (A. H. 1178); it produced a climbing stem with small elongated leaves, not unlike a bamboo; after a year's time he dug it up, but found that the roots had degenerated and did not retain the qualities of the China article. Chub-chini is considered by these writers to be anti-rheumatic, anti-syphilitic, aphrodisiacal, and demulcent. Loureiro says of it, "valet in quibuscunque doloribus vagis, venereis, aut rheumaticis."

Ainslie (*Mat. Ind.*, i., 70) notices its use in Southern India as an anti-syphilitic and as a remedy of much repute in a disease called *maygum vaivoo*, in which the limbs are stiff and contracted. He also states on the authority of the Abbé Rochon* that "the Chinese often eat the root instead of rice, and that it contributes to make them lusty." Roxburgh states that the *Smilax glabra*, a native of Sylhet and of the adjacent Garrow country, where it is called *Hurina-shook-China*, has large tuberous roots, not to be distinguished by the eye from China-root, and that the natives of the country use a decoction of the fresh root for the cure of sores and venereal complaints (*Flora Indica*). This plant also grows in China and affords some of the China-root of commerce. (Trimen's *Journ. of Bot.*, i., 102.)

The reported good effects of China-root on the Emperor Charles V., who was suffering from gout, acquired for the drug a great celebrity in Europe, and several works were written in praise of its virtues. But though its powers were soon found to have been greatly over-rated, it still retained some reputation as a sudorific and alterative, and was much used at the end of the 17th century in the same way as sarsaparilla. It still retains a place in some modern pharmacopœias. (*Pharmacographia.*)

* Voyage to Madagascar and the East Indies, London, 1792.

In the East, Chub-chíní is still as highly esteemed as it ever was, and the China Trade Returns show a steady yearly increase in the quantity shipped from Southern China.

Description.—The tubers, which are formed upon the fibrous roots of the plant, are of the shape and size of an elongated kidney potato, somewhat flattened, knotty, covered with a rusty-coloured bark, sometimes smooth and shining, sometimes rough; internally their substance is of a pinkish-white colour, hard and farinaceous, insipid, mucilaginous and inodorous.

The drug is usually peeled and trimmed, and consequently is of irregular form, resembling a piece of heavy pinkish-white wood.

Microscopic structure.—The bark consists of thick-walled dark-brown brick-shaped cells, which contain bundles of crystalline needles and resinous matter. The bulk of the tuber is made up of a parenchyma, the cells of which are large, thin-walled, and loaded with starch, some pink colouring matter is also present. The starch grains are large and have a radiate hilum. The vascular system is scalariform, and is associated with porous wood cells.

Chemical composition.—The authors of the *Pharmacographia* endeavoured to obtain from the drug *Parillin,* the crystalline principle of sarsaparilla, but without success.

A proximate analysis of the air-dried drug afforded:—

Ether extract (fat)	0·33
Alcoholic extract (sugar, glucoside)	1·72
Aqueous extract (sugar, gum, &c.)	6·79
Crude fibre	13·79
Ash	1·47
Moisture	6·10
Starch (by difference)	69·80
	100·00

This root contained no alkaloid, but the alcoholic extract contained a glucoside, and a colouring matter which gave an olive-green tint with ferric chloride, but no precipitate with gelatine. With soda it afforded a deep red colour, and was precipitated from solution by neutral plumbic acetate. The sugar present abundantly reduced Fehling's test without previous inversion. The amount of ash, consisting of alkaline salts is very small.

Professor Kobert has recently separated from true sarsaparilla three glucosides, smilacin, sarsasaponin, and parillin,—these compounds differ in physiological activity, but are members of a homologous series to which has been assigned the general formula $C^n H^{2n}—^8O^{10}$.

Commerce.—From 16,000 to 17,000 peculs of 133 lbs. each are annually produced in Southern China. The greater part is consumed in China, but a very considerable portion must reach India, as the drug is to be found in every bazar throughout the country.

Smilax ovalifolia, *Roxb., Rheede, Hort. Mal. vii., t.* 31, Janglí-ushbah (*Hind.*), Malai-támara (*Tam.*), Konda-támara (*Tel.*), Gútwel, Gútí (*Bomb.*), Kal-támara (*Mal.*), is a climbing shrub very common in the Concans. The roots are very numerous, and have a general resemblance to sarsaparilla. A section shows a dry, suberous, brown bark; secondly, one row of 5-sided yellow cells, which are more or less wedge-shaped, their nuclei being situated towards the apices; thirdly, a range of numerous rows of ovoid cells, variable in size, with central nuclei; these extend as far as, and partially surround, the vascular zone, which consists of large vessels with generally two smaller ones in contact with them. Within the vascular zone the central portion of the root is made up of large thin-walled cells, filled with starch or red colouring matter; the latter is most abundant in young roots. The drug is not used by the natives, but in Goa it is kept in all the shops, and is the country sarsaparilla of the Portuguese.

DRACÆNA CINNABARI, *Balf. f.*

Fig.—*Balf. f. in Trans. Roy. Soc. Edin. xxxi.*, Tab. xcvi—xcvii. Dragon's blood (*Eng.*), Sang-dragon (*Fr.*).

Hab.—Socotra. The resin.

Vernacular.—The tree—Kharya (*Socotra*). The resin—Dam-khoheil, Edah (*Socotra*), Dam-el-akhwain (*Arab., Ind. Bazars*), Hira-dukhi (*Hind.*), Hira-dakhan (*Bomb.*), Kándamurgarittam (*Tam.*), Katgamurgam-nitúru (*Tel.*).

History, Uses, &c.—On the Deir-el-Bahari monument at Thebes, erected by Hatasu, a queen of the 18th dynasty, who lived about 1700 B.C., there are representations showing the commissioner of the queen going over the sea to the country of Punt and of 'To Nuter,' and bringing therefrom, amongst other things, plants bearing 'Ana,' which is shown as a gum or resin in the form of red tears on the stems of small trees with ovate-lanceolate leaves. The To Nuter of the inscription has been identified with the Sacred Islands of Pliny, and the modern archipelago, including Socotra. The gum or resin is probably dragon's blood, as that is the most remarkable substance of the kind produced on the island. The author of the Periplus of the Erythrean Sea, A.D. 54-68, mentions κιννάβαρι as a production of the island of Dioscorida, the ancient Greek name of Socotra. Dioscorides (v. 63) notices its medicinal uses under the same name, and states that it is produced in Libya (Africa). Both he and Pliny (33, 38) distinguish it from the mineral cinnabar; the latter writer states that the price of genuine cinnabaris is fifty sesterces per pound. A myth was current among the Greeks and Romans that this substance was the blood of the dragon or python crushed beneath the weight of the dying elephant, round which it had wound itself to suck the animal's blood. Rufus Ephesius and Galen notice the use of the drug for stopping hæmorrhage from wounds.

Among the Arabs it bears many names, such as Dam-el-akha-wain, Shayyán, Aidá vulg. Edá, Dam-el-tinnín, and Dam-el-thuabán "dragon's blood," Elándam, Kátir-ed-dam, and later El-kátir-el-makki vulg. Katr-makkeh. Johanna-bin-Masawiyeh, physician to the Caliph Haroun-el-Rashid, specially recommends it for strengthening the stomach and liver, and as an astringent ingredient in collyriums. On account of its use as a collyrium, the Arabs sometimes call it Dam-kuhl or simply Kuhl "collyrium."

Among the Persians it is known as Khún-i-siyáwash, and they have a myth that when Afrásiáb killed Siyáwash, this plant sprung up upon the place where his blood was shed. The author of the *Burhán*, who relates this story, also remarks that the gum is said to come from Africa. Haji Zein (1368) notices three qualities of dragon's blood, *viz.*, Chakideh 'drop,' Turábi 'earthy,' and Khashabi 'mixed with wood.' He says it is not the gum of the *bakam* (*Cæsalpinia Sappan*) as supposed by some, but of a tree growing in Africa. The author of the *Tuhfat-el-muminín* states that the plant which produces it is not known; he notices its use for painting glass. The author of the *Makhzan* (1770) merely repeats what older writers have said.

Ainslie (*Mat. Ind.*, i., 113) remarks that it is often confounded with Kino by the native doctors of Lower India. The Tamool doctors recommend a solution of it in arrack as an external application to the head and temples in cases of syncope.

Although the early European travellers in the East mention Socotra dragon's blood, Guibourt and Pereira do not notice it, and nothing exact regarding its source was known until Wellstead (*Journ. Roy. Geog. Soc.*, v. (1835), 198) described the tree, but wrongly supposed it to be *Pterocarpus Draco.*

Professor Bayley Balfour, who visited Socotra a few years ago to examine the fauna and flora of the island, was the first

to give us any exact information concerning the species of Dracæna yielding dragon's blood in Socotra, and the way in which it is collected. He says, the resin exudes most abundantly immediately after the rainy season; the natives collect it by chipping it off with a knife into a small bit of skin placed against the tree; there are different qualities collected: 1*st*, the large tears, which are the best and most expensive, and are called *Edah amsal* (ايدع امثال best Edah); 2*nd*, small portions which become detached, forming powdery dragon's blood or *Edah dukkah* (ايدع دقه Edah dust); 3*rd*, an inferior kind, obtained by melting the refuse into cakes, called *Edah mikdhah* (ايدع مقدحه Edah of the ladle).

Description.—The best quality may at once be distinguished by its occurring in tears, the surface of which is covered by a dull red powder. When broken, the surface is glassy, translucent, and of a beautiful garnet colour. Imitation tears are manufactured in India from the powdery dragon's blood; they may easily be detected by their wanting the glassy fracture of the genuine article. Cake dragon's blood is also met with; it is of a dull red colour, and contains fragments of bark-wood, and other refuse.

Chemical composition.—See *Calamus Draco.*

Commerce.—The drug is imported into India through Bombay.

Zanzibar Dragon's blood is similar in appearance to that which comes from Socotra, and is not distinguished from it in Indian trade. Hildebrandt has ascertained that it is obtained from the stems of *Dracæna Schizantha* (Baker).

The natives remove pieces of the bark about two inches square, and the cavity in two to three weeks' time becomes filled with the resin. In Zanzibar it is used in ophthalmia, and is said to be called "Maczіwa ya watu wawili," meaning the milk of two men, or "Matcho ya watu wawili," the eyes of two men.

BROMELIACEÆ.

ANANAS SATIVA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1554; *Rheede, Hort. Mal. xi.*, *t.* 1. Pine-apple (*Eng.*), Ananas (*Fr.*).

Hab.—America. Cultivated throughout the East. The fruit and leaves.

Vernacular.—Anannás (*Hind.*), Anánas, Anáras (*Beng.*), Annás, Aunás (*Mar.*), Anáras (*Guz.*), Anásha-pazham (*Tam.*), Aṇása-pandu (*Tel.*), Kaita-chakka, Parangi-chakka (*Mal.*), Anánasu-hannu (*Can.*).

History, Uses, &c.—The Pine-apple was unknown in India prior to the discovery of America; it was first made known to Europe by Hernandez in 1513, and was introduced into India by the Portuguese from Brazil in 1594. Its introduction is mentioned by Abu Fazl in the *Ayeen-i-akbari*, and also by the author of the *Dára Shakoh.* The vernacular names are mostly derived from the American names *Anasi* and *Nanas*, but the Malabar name Parungi-chakka signifies "European Jack fruit." Rheede states that in Malabar the leaves boiled in rice-water and mixed with *Pulvis Baleari* afford a drink which is given to dropsical patients to purge off water; the unripe fruit is given with vinegar to cause abortion and to relieve flatulent distension of the abdomen. The author of the *Makhzan-el-Adwiya* describes two kinds of pine-apple, *viz.*, the ordinary kind, and a small kind of superior sweetness and flavour called *Kaunla.* He says that the fruit is cold and moist, suitable to those of a bilious temperament, but not to the phlegmatic; to lessen its coldness it should be cut in thin slices and washed in salt and water and afterwards in pure water; it may then be sprinkled with sugar and rose-water and eaten. A little ginger is also said to render the fruit more wholesome. Pine-apple chutney, preserve, and sherbet are also mentioned, but nothing is said about the

medicinal use of the leaves and unripe fruit. From the special opinions of medical officers in India recorded in the *Dict. Econ. Prod. of India* (i., 238), it appears that a belief in the abortifacient properties of the leaves and unripe fruit is common throughout India among the natives.

Chevers (*Med. Juris.*, p. 715), on the authority of Babu Kanny Lall Dey, has the following description of its use in Bengal:—"A green, unripe one, only half-grown is used. It is decorticated, and the pulpy mass of a whole one is administered to the woman with a small quantity of salt. It is efficacious only during the earlier months of pregnancy; and, after the third month, its action is very doubtful. But, if administered to suitable cases, the uterus begins to contract within twelve hours, when slight hæmorrhage occurs also. Its action then increases, and within the course of twenty-four hours the ovum is expelled. Occasionally the woman's life is jeopardized by flooding, but, as a rule, there is not much danger to be apprehended." Again, at page 718, Chevers says: "A note which I have from Babu Koylas Chunder Chatterjee renders this matter plain. He says that acid fruits are regarded as abortives. He knew a case in which a woman aborted at an advanced stage of pregnancy by eating (with that intention) about two pounds of ripe pine-apple. This fruit is rendered unwholesome by the presence of a very strong fibre which acts as a mechanical irritant on the bowels. I had under my own care an English lady who died of dysentery, after having aborted, at about the fifth month of pregnancy. The cause of her illness appeared to be the ravenous eating of raw pine-apple."

Description.—The plant is biennial, not unlike an aloe, but the leaves are much thinner, and of a hard fibrous texture, with numerous short sharp spines on the edges. The fruit is produced on a short stem which rises from the centre of the plant, and bears a scaly conical spike, surmounted by a number of small spiny leaves called the crown. This conical spike bears a number of small bluish flowers having three petals and a 3-parted calyx; after flowering, it gradually enlarges and eventually becomes a succulent fruit of a rich orange-yellow colour.

Chemical composition.—The essence of pine-apple is prepared artificially by mixing butyrate of ethyl with 8 or 10 parts of spirit of wine. Pine-apple juice contains a proteid-digesting ferment. Three fluid ounces digest 10 to 15 grains of coagulated albumen; it acts equally well in acid and alkaline solutions, and best in a neutral fluid. The juice also contains a milk-curdling ferment.

The ash has the following composition:—

Potash	49·42	per cent.
Magnesia	8·80	„
Lime	12·15	„
Phosphoric acid	4·08	„
Sulphuric acid	trace.	
Silica	4·02	„
Phosphate of iron	2·93	„
Chloride of sodium	17·01	„
Chloride of potassium	·88	„

(Quoted by Kensington in *Chemical Composition of Foods, &c., &c.*)

COMMELINACEÆ.

COMMELINA BENGALENSIS, *Linn.*

Fig.—*Clarke, Comm. et Cyrt.*, 14, pl. iv.; *Wight Ic.*, *t.* 2065.

Hab.—Bengal, Peninsula, Sind, Concan. The herb.

Vernacular.—Kánchara (*Hind.*), Káchrádám, Kánchara (*Beng.*), Chura, Kanna (*Punj., Sind*), Kena (*Mar.*), Kanang-karai (*Tam.*), Venna-devi-kura, Niru-kassuvu (*Tel.*), Hittaganí (*Can.*).

History, Uses, &c.—This and several other species of Commelina are included under the Sanskrit name of Kanchata. They are small herbaceous plants which appear everywhere towards the end of the rainy season and are remarkable for their brilliant blue flowers. The stems, roots, and seeds which

contain much mucilage and starch are used on account of their demulcent properties, and are eaten in times of scarcity. *C. communis* is said by Loureiro to be refrigerant and laxative, and to be useful in strangury and costiveness.

Tradescantia axillaris, *Willd., Rheede, Hort. Mal. x., t.* 13. A very similar plant, and often called by the same vernacular names, has similar properties, and its seeds have frequently proved to be a valuable resource in times of famine. Ainslie notices it under the Tamil name of Nirpulli (*Mat. Ind.*, ii., 250).

Lyon found the seeds to have the following percentage composition:—Water 10·26, fat 0·62, albuminoids 15·99, carbohydrates 54·79, cellulose 9·36, ash 8·89. The nitrogen was estimated at 11·28 grains per oz., and the nutritive carbon at 145·80 per oz. He calculates the nutritive value of the seeds as compared with the average cereal at 100·00 to be 85·76.

XYRIDEÆ.

XYRIS INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 71.

Hab.—Salt marshes in Bengal, S. Concan, and Coromandel. The herb.

Vernacular.—Dádmári (*Hind.*), China-ghauza, Dábi-dúba (*Beng.*), Kochilítti-pullu (*Tam.*), Kochilachi-pulla (*Mal.*).

History, Uses, &c.—Xyris (ξυρίς) is a name given by Dioscorides (iv., 24) to a species of Iris, which has been identified with *fœtidissima*, Linn. Pliny (21, 83) speaks of the same plant as the wild Iris called by some Xyris; it appears to have been applied locally to disperse scrofulous swellings and to promote the healing of sores, and given internally as a diuretic and alterative. Linneus transferred the name to a genus of flag-like plants growing in the East and West Indies. *X. indica* does not appear to be mentioned in any of the standard native medical works, but Rheede notices its use in Malabar in

the following terms:— "Foliorum succus cum aceto mixtus impetigini resistit; folia cum radice oleo incocta contra lepram sumantur; cum *mungo* (*Phaseolus Mungo*, Linn.) decocta et epota somnum consiliant." Agardh, the Swedish botanist, notices its use as a remedy for itch and leprosy. Ainslie gives the plant a place in his *Materia Indica* (ii., 125), but merely repeats what Rheede has already said. Roxburgh gives a full description of it, and remarks on the authority of the Hon'ble J. Hyde that "the natives of Bengal esteem it a plant of great value, because they think it an easy, speedy, and certain cure for the troublesome eruption called ringworms."

Description.—Root fibrous, annual; leaves radical, bifarious, straight, sword-shaped, on one edge slit into a sheath for the scape, pointed, smooth, 6—12 inches long; scape naked, round, striated, erect, length of the leaves, each supporting a round, flower-bearing head; flowers, bright yellow; bracts 1-flowered, orbicular, concave, hard, smooth; calyx 3-leaved, hid within the scale, membraneous; petals three, each supported on an unguis just long enough to raise their expanding, oval, crenate borders above the scales; filaments three; anthers twin; germ superior, 3-sided; style 3-cleft; stigma torn; capsule 3-valved, 1-celled; seeds numerous. (*Roxburgh.*)

Chemical composition.—The plant contains a red colouring matter soluble in alcohol and intensified by alkalies and having some reactions peculiar to chrysophanic acid.

PALMÆ.

COCOS NUCIFERA, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 73; *Rheede, Hort. Mal. i., tt.* 1 to 4. Cocoanut (*Eng.*), Cocotier (*Fr.*).

Hab.—Indian Archipelago and coasts of India. The flowers, fruit, shell, oil, juice, tomentum, root, and ash.

Vernacular.—Nárryal (*Hind., Beng.*), Náriyál (*Guz.*), Náral, Nárali mád (*Mar.*), Tenha, Tenna-maram (*Tam.*), Nári-kadam,

Tenkaya-chettu (*Tel.*), Tengina-gida, Tengino-káyi (*Can.*), Tenga, Ten-maram (*Mal.*).

History, Uses, &c.—The cocoanut, formerly written coconut, derives its European names from the Portuguese *coco*, "a mask." Garcia ab Horta says: "We have given it the name of *coqus* on account of its having three holes which cause it to resemble the face of a càt or similar animal." The resemblance, however, of this nut to a head and face had not escaped the notice of the Hindus; long before the Portuguese had set foot in India, *náral* was used as a cant term in the sense of head, pate, sconce, &c., and was sometimes used to represent the head of a dummy figure by the relatives of a deceased person whose body could not be found, and who nevertheless were desirous of rendering to it the usual funeral rites. Various superstitious uses to which the cocoanut is put in India attracted the notice of the early missionaries. Vincenzo Maria da Santa Caterina (*Viaggio alle Indie Orient.*, iii., 29) states that when an Indian falls sick, they spin a cocoanut; if it stops with its face towards the West, the sick person will die, but if it faces the East, he will recover; he also notices the offering of a cocoanut at the commencement of any building. To this we may add that on the Western Coast cocoanuts are offered to the Sea on the day of the full moon of Shravan, when the monsoon is supposed to terminate. It is related that in former days the European Governor of Bombay used to go in state and throw a golden cocoanut into tho sea on this day. In Hindustan there is also a practice among the Indian Mahometans of breaking a cocoanut to ascertain whether a pregnant woman will be delivered of a male or female child; if it is empty she will be delivered of a son, if not, of a daughter: this is called "nariyal torna." Breaking a cocoanut against the wall of a person's house is in Western India an indication of enmity to the inmates of the house, and is connected with the practice of smelling the heads of children before allowing them to leave the house. The *utarna* or casting away of disease or misfortune may be performed by carrying a cocoanut to a distance from the house and breaking it.

Among the Hindus the most important function of this nut is at marriages, when it is the custom to place the *tâli* of the bride, which the parents must see and touch in token of their approbation of the marriage, in the half of a broken cocoanut. Here the *táli* and nut represent *le jeu des époux*. De Gubernatis relates that the continuance of this practice among their converts greatly exercised the patience of the Jesuit missionaries, and that the matter was finally settled in 1704 by a decree of the Cardinal de Tournon to the following effect:—"Fructus etiam vulgo dictus Coco, ex cujus fractione prosperitatis vel infortunii auspicia gentiles temere ducunt, vel omnino a Christianorum nuptiis regiciatur, vel saltem, si illum comedere velint non publice sed secreto et extra solemnitatem apariatur ab iis qui, evangelica luce edocti, ab hujusmodi auspiciorum deliramento sunt alieni." In the coast districts, cocoanuts and sugar-cakes (*náral, batása*) are lavishly distributed to the guests on important festive occasions, such as marriage, the *phool* ceremony on the event of the first menstruation and first pregnancy, and the thread ceremony; in other parts of India their place is supplied by betel-nuts. In Europe nuts appear to have been always regarded as auspicious and symbolical of fertility; the Romans scattered nuts at weddings; Virgil says, "Sparge, marite, nuces," and De Gubernatis states that this custom still exists in several parts of Southern Europe; in Piedmont there is a proverb: *Pan e nus vita da spus.*

The economic uses to which the cocoanut tree and its products are put in the East, are so numerous, and have so often been described, that we will not attempt to recapitulate them, but refer the reader to the *Dictionary of the Economic Products of India* (ii., 415). At the Colonial and Indian Exhibition, Mr. M. C. Pereira, Head Assistant to the Government Medical Storekeeper, Bombay, exhibited a collection of eighty-three articles prepared from the tree, and we are informed that he has since added considerably to his collection.

Sanskrit medical writers describe the tree under the name of Nárikela or Nárikera, and give it many synonyms, such as Tunga "lofty," Trina-rája "king of grasses," Skandha-taru

"stem tree," Dur-ároha "difficult of ascent," Kúrcha-sekhara "crowned with a bunch of fruit," Dridha-phala "having hard fruit," Rasa-phala "having juicy fruit," Dridha-nira "having strong juice," &c. The tree also bears the name of Langala "membrum virile."

Dutt (*Mat. Med. of the Hindus*, p. 247) gives the following summary of the medicinal uses of the cocoa palm mentioned in Sanskrit medical works:—"The water of the unripe fruit is described as a fine-flavoured, cooling, refrigerant drink, useful in thirst, fever, and urinary disorders. The tender pulp of the fruit is said to be nourishing, cooling, and diuretic. The pulp of the ripe fruit is hard and indigestible, but is used medicinally in the preparation called *Nárikela-khanda.* The terminal bud of the tree is esteemed as a nourishing, strengthening, and agreeable vegetable. The root of the tree is used as a diuretic, and also in uterine diseases. The oil is said to promote the growth of the hair and to prevent it from turning grey, and is much used by native women; in Bengal it is scented and sold under the name of *Máthághasá.* The ashes of the leaves are used in medicine, and contain much potash. The fresh juice of the tree is considered refrigerant and diuretic; when fermented it constitutes one of the spirituous liquors described by the ancient writers. The cleared shell of the nut is burnt in the fire, and when thoroughly ignited covered up in a stone cup, the fluid thus obtained is rubefacient, and is an effectual domestic remedy for ringworm. The nárikela-khanda already mentioned is made in the following manner:—Take of the pounded pulp of cocoanut half a sér, fry it in eight tolas of clarified butter, and afterwards boil in four sérs of cocoanut water till reduced to a syrupy consistence. Now add coriander, long-pepper, bamboo manna, cumin and nigella seeds, cardamoms, cinnamon bark and leaves, cyperus root and the flowers of *Mesua ferrea,* one tola each in fine powder, and prepare a confection. The dose is two to four tolas, in dyspepsia and consumption.

The cocoa palm is supposed by some to have been the κουριόφορον (δένδρον) of Theophrastus (H. P. iv., 2, 7), and the

Cuci of Pliny (13,19), but their description appears to agree better with the *Hyphæne coriacea* or Doom palm of Egypt. The Arabs call the cocoanut Nárjil, and the Persians Nárgil, Bádinj, and Ránaj; their physicians describe it as hot and dry, nutritive and aphrodisiacal, beneficial to those suffering from piles; the kernel when it has been kept for some time is considered to be anthelmintic. They remark that it is not easily digested, especially when old.

European physicians, who have practised in India, recommend the water contained in the unripe fruit as a cooling, refrigerant drink, useful in fever and urinary disorders. The milky fluid obtained by pulping the unripe kernel and expressing it has been recommended as a nutritive diet in debility and cachexia; in large doses it is aperient, and Mr. Wood has suggested its use as a substitute for castor oil. (*Pharmacopœia of India.*) The anthelmintic properties of the cocoanut noticed by Mahometan writers have been confirmed by European observers; the dose is the rasped kernel of a single nut, followed by a dose of castor oil. Cocoanut oil has been recommended as a substitute for cod liver oil, but its prolonged use is said to induce disturbance of the digestive organs and diarrhœa; this objection may be removed by using the olein separated from the solid fats, as is done by the natives in the preparation of what they call *muthel* or hand oil. To prepare this the kernel of the fresh nuts is pulped and strained and the oil separated from the milky fluid by heating it; a preparation of the same kind is now known in Europe as *coco-olein.* Cocoanut oil is not suitable as a vehicle for liniments, but the soap prepared from it, and known as *marine soap,* may be used in plaster-making and in the preparation of soap liniment; it is freely soluble in spirit. A purified cocoanut oil has of late years been introduced in Germany as a substitute for lard; it has been recommended to pharmacists as less liable to rancidity than lard. The saccharine juice obtained by cutting the spathe of the cocoa palm, when fermented and distilled, yields a clean spirit suitable for pharmaceutical purposes.

Description.—The cocoa palm, which has now been introduced into all tropical countries, grows to a height of 70 or 80 feet, and has at the apex a tuft of leaves which are twelve feet or more in length and have numerous narrow rigid leaflets. The spathe, from which toddy is obtained, when undisturbed produces numerous yellowish-white flowers succeeded by the fruit, only a small proportion of which come to maturity in about twelve months from the time of flowering. The immature fruit contains a clear sweet fluid, which gradually dries up as the nut ripens. The kernel which lines the interior of the shell, after the nuts have been kept for some time, dries up and separates from it, and is then called *khopra*; from it is obtained by hot pressure or by boiling in water the cocoanut oil of commerce, which has a mild, bland taste, a pale yellow colour, and peculiar odour. In hot climates it remains fluid, but when exposed to cold, it becomes of a butyraceous consistence and white colour. Its melting point varies between 22° and 30°C; the cold pressed oil melts at 20°C. or less; the fused, thin, transparent yellowish oil congeals between 18° and 12°C. After having been heated it remains liquid for several days. The oil is readily saponified at a low temperature, the soap being white, hard, and capable of uniting with much water.

Chemical composition.—Fresh cocoanut kernel contains water 46·64, nitrogenous substances 5·49, fat 35·93, non-nitrogenous extract 8·06, lignin 2·91, ash 0·97 per cent., and when dried yields nitrogen 1·65 and nitrogen free extract 67·33 per cent. (*König in Hammerbacher Landw. Versuchssk.* Bd. 13, s. 243.) Palm sugar examined by P. Horsin Deon (1879) yielded water 1·86, cane sugar 87·97, inverted sugar 9·65, other substances 0·50 per cent., and when dried 89·64 per cent. of cane sugar. The other organic substances consisted of 1·71 per cent. reducible sugar, 4·88 gum, and 3·06 mannite and fat. (*König, Nahrungs-mittell.*)

The milk of ripe and unripe cocoanuts has been analysed by L. L. van Slyke. The weight of milk from unripe nuts varied from 230·5 to 383·7 grams, and in a ripe nut only 109·6 grams.

The composition of the unripe milk is an average of six analyses :—

	Milk of unripe nuts.	Milk of ripe nuts.
Water at 60°	95·00	91·23
Ash	·617	1·06
Glucose..................	3·973	trace.
Cane sugar	trace.	4·42
Proteids	·133	·291
Fat	·119	·145

(*Journ. Chem. Soc.*, June, 1891.)

According to Hammerbacher, the fresh milk has the following composition :—

Water......................................	91·50	per cent.
Albuminoids	·46	„
Fat	·07	„
Nitrogen free extractive	6·78	„
Ash	1·19	„

The milk had a sp. gr. of 1·0442. No fatty acids were present, except, perhaps, propionic.

For the composition of cocoanut *pearls*, the reader is referred to *Nature* for 1888.

Cocoanut oil has a peculiar and highly complex chemical composition. It is largely composed of the glyceride of lauric acid, $C^{12}H^{24}O^{2}$, and contains even lower homologues (*e.g.* capric, caprylic, caproic) capable of distillation in a current of open steam, and to some extent soluble in water; but the glycerides of myristic, palmitic, and stearic acids are also present in notable proportion. On the other hand, the low iodine absorption shows that comparatively little olein or its homologues can be present. (*Allen.*)

Commerce.—In 1880-81 the foreign exports of cocoanut oil amounted to 1,888,122 gallons, valued at Rs. 20,90,797, Madras

alone having shipped to foreign countries 1,690,520 gallons, and sent in addition to other Indian ports 1,493,756 gallons. In 1886-87 the exports were 1,099,864 gallons, valued at Rs. 13,24,589, and the imports 556,562 gallons, valued at Rs. 7,54,515. The bulk of the exports (*viz.*, 689,087 gallons) went to the United Kingdom. The imports were mainly from Ceylon (438,144 gallons), Bengal taking by far the largest proportion (*viz.*, 350,437 gallons). If to these facts an abstract of the coasting traffic be added, some idea of the present position of the cocoanut oil trade may be had. The imports coastwise were in 1888, 167,486 gallons, valued at Rs. 2,05,60,067 ; the exports were 1,942,829 gallons, valued at Rs. 20,74, 455. Of the imports, Bombay received 794,577, Burma 338,056, Bengal 131,463 gallons, and these quantities were almost entirely obtained from Madras. Cochin sent to Bombay 15,789 gallons, and to Madras 13,188 gallons. The other items to make up the total coastwise imports were unimportant. Local production added to these imports would constitute the supply from which the exports could be made, and in the case of Madras it is noteworthy that that Presidency imported practically no cocoanut oil, so that her exports to foreign countries and to other Indian ports were drawn exclusively from local supplies. With the exception of the small amounts obtained from Cochin, Bombay, &c., and some 6,000 gallons from Ceylon and other foreign countries, Madras imported no cocoanut oil. But she exported 1,754,701 gallons, of which 1,008,621 went to Bombay, 273,347 to Burma, 191,413 to Travancore, and 155,202 gallons to Bengal. But Bengal exported coastwise 8,648 and Bombay 3,454 gallons. The Bengal exports went to Burma, and the Bombay to Sind, Madras, Goa, Kattywar, &c. Adding the foreign exports to the coastwise exports and deducting total of the imports, we learn that Madras exported in 1888, 3,425,221 gallons—an amount which may be viewed as the surplus over local consumption. Turning to Bengal and Bombay, a very different state of affairs is found to prevail—the imports exceed the exports, in Bengal by 313,009 gallons, and in Bombay by 1,125,572 gallons. An enormous trade in

cocoanut oil is done in Cochin, as will be seen from the exports for six years:—

	Europe.	India, Burma, &c.	Total Tons.
1884-85	6,613	6,066	12,679
1885-86	3,494	7,237	10,731
1886-87	4,967	5,382	10,349
1887-88	6,300	6,048	12,348
1888-89	6,193	7,775	13,968
1889-90	4,048	8,264	12,312

A very imperfect idea of the supply and demand for this oil would, however, be conveyed, were we to omit to examine the trade in dried kernel, the substance from which the oil is expressed. This is largely exported to foreign countries and sent from one province of India to another. In 1886-87 the imports were 125,222 cwts., valued at Rs. 11,76,799, and the exports 9,337 cwts., valued at Rs. 79,836. The imports come chiefly from Ceylon and the Straits Settlements, and are almost exclusively delivered in Bengal and Bombay. The exports go mainly from Madras, the greater part to Portugal, Persia, Russia, and Arabia, each receiving from 300 to 500 cwts. Of the imports by far the larger portion was received in Bombay.

Borassus flabelliformis, *Linn. Rheede, Hort. Mal. i., tt.* 9, 10, is the Palmyra palm of the English, and the Roudier a éventails of the French. In Sanskrit it is called Tála, and in the vernaculars Tál, Tád, Tár, and Panai-maram. The properties of the various parts of this noble palm are described in detail in Sanskrit medical works. The root is considered to be cooling and restorative; the saccharine juice obtained from the spathe cooling and diuretic when fresh, but intoxicating when fermented; the pulp of the ripe fruit heavy and indigestible; the gelatinous contents of the unripe seeds refreshing and cooling; the embryo of the germinating seed, and the terminal bud of the tree, are used as vegetables, and are considered to be cooling, nutritive, and diuretic; the ash of the spathe is given as a remedy for enlarged spleen.

The spirit distilled from the juice of this palm is similar to that obtained from the cocoa palm.

The fine, brown, silky substance on the young petioles of the leaves of this and other palms is used as a styptic.

B. flabelliformis yields an insoluble gum, like tragacanth, but of a darker colour.

For an account of the economic uses of this palm, the reader is referred to the *Dict. Econ. Prod. India*, i., p. 495.

Phœnix sylvestris, *Roxb., Rheede, Hort. Mal. iii., tt.* 22 to 25, Kharjura (*Sans.*), Kajúr (*Hind., Beng.*), Sendí (*Mar.*), Ishan-chedi (*Tam.*), also yields a juice, from which spirit is obtained. The fruit called *Khárik* pounded and mixed with almonds, Quince seeds, Pistachio nuts, spices and sugar forms a *Paushtik*, or restorative remedy much in vogue. A paste formed of the seeds and the root of *Achyranthes aspera* is eaten with betel leaves as a remedy for ague.

The juice of this palm is obtained by tapping the trunk.

LODOICEA SEYCHELLARUM, *Labill.*

Fig.—*Bot. Mag.*, 2734-5-6-7-8. Sea Cocoanut (*Eng.*), Coco-de-mer (*Fr.*).

Hab.—Seychelles.

Vernacular.—Darya-ka-náriyal (*Hind.*), Kadat-rengay (*Tam.*), Samudrapu-tenkaya (*Tel.*), Katal-tenna (*Mal.*), Darya-nu-náriyal (*Guz.*), Jahari-náral (*Mar.*).

History, Uses, &c.—Prior to the discovery of the Seychelles Islands in 1743, the large and peculiar-shaped nut of this palm, found floating in the Indian Ocean, was an object of curiosity which gave rise to many fabulous tales; it was called Sea Cocoanut and Coco-de-mer by Europeans, Narjíl-bahrí by the Arabs, Narjíl-i-daryaí by the Persians, and important medicinal virtues were attributed to it. It is now no longer valued by Europeans, but is still in great repute among the Arabs and Indians as a tonic, preservative, and alexipharmic.

Rumphius gives a long account of this palm under the name of *Cocos Maldivicus.* The kernel is used in India in conjunction with *lignum colubrinum* as a tonic, and a paste made of it in conjunction with the powdered horns of the Sambhar deer and the seeds of *Strychnos Nux-vomica* is applied to enlarged glands.

Description.—Thomas Moore, in the *Treasury of Botany*, says: "This magnificent palm, which is found only in two small islands, Praslin and Curieuse, belonging to the Seychelles group, requires a great length of time to arrive at maturity. The shortest period before it puts forth its flower-buds is thirty years, and a hundred years elapse before it attains its full growth. From the age of 15 to 25 years it is in its greatest beauty, the leaves at this period being much longer than they are subsequently. The stem grows quite upright, straight as an iron pillar, and in the male trees frequently attains a hundred feet in height, the females being shorter. At the age of thirty, it first puts forth its blossoms, the males forming enormous catkins about three feet in length and [illegible] in diameter, while the females are set [illegible] strong zigzag stalk, from which hang four or five, [illegible] sometimes as many as eleven nuts, averaging about [illegible] lbs. weight each. From the time of flowering to the maturation of the fruit, a period of nearly ten years elapses, the full size, however, being attained in about four years, at which time it is soft and full of a semi-transparent jelly-like substance. The apparently peculiar formation of the root portion of this tree attracted much attention a few years since, but upon comparison with other palms it seems to be explained as an extraordinary development of a common [illegible] system. The base of the stem is rounded and fits into a natural bowl or socket, which is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots [illegible] penetrate the ground on all sides, never, however, becoming attached to the bowl, their partial elasticity affording an almost imperceptible but very necessary 'play' to the parent stem when struggling against the force of violent gales. This

bowl is of the same substance as the shell of the nut, only much thicker; it rots very slowly, for it has been found quite perfect and entire in every respect sixty years after the tree has been cut down." The fruits are covered externally with a thick fibrous husk, and contain usually one, but sometimes two or even three immense nuts with hard thick black shells, each being divided half-way down into two lobes. The kernel is from three-quarters to one inch thick, and very hard and white, having much the consistence of vegetable ivory: it has no odour or taste; when soaked in water it softens a little, and can be split into thin fibrous bundles.

Microscopic structure.—The kernel is composed of spindle-shaped cells having a central cavity, from which club-shaped canals extend to the cell-wall, where they are opposed to similar canals belonging to a neighbouring cell.

Commerce.—The nuts are an article of export from the Seychelles; hundreds of them may be seen at Port Victoria, Mahé, whither they are brought from the island of Praslin. Value in Bombay, Re. 1¼ per lb. for the dry kernel.

Entire nuts fetch from Re. 1 to Rs. 2 each, according to their size.

ARECA CATECHU, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 75; *Bentl. and. Trim., t.* 276. Areca palm (*Eng.*), Arec cultivé (*Fr.*).

Hab.—Cochin-China, Malay Peninsula and Islands. Cultivated throughout tropical India. The seed.

Vernacular.—Supári (*Hind., Beng., Guz., Mar.*), Kamugu, Pákku (*Tam.*), Póka-vakka, Vakka (*Tel.*), Adike (*Can.*), Adaka (*Mal.*).

History, Uses, &c.—The betel-nut, in Sanskrit Guváka, Puga, and Kramuka, is a masticatory of great antiquity in the East. In the *Panchadandachattraprabandha*, Devadamani, "she who compels the gods," goes to the court of king Vīkramáditya to play with him, dressed in a sky-blue robe, having in her

hand and in her mouth a betel-nut wrapped in a leaf of the *kalpa*, one of the trees of Indra's paradise, a fabulous tree, granting all desires. The betel-nut is symbolical of festivity, and is a phallic emblem. Vincenzo Maria da Santa Caterina in his Viaggio alle Indie Orientale says:—"The Hindus adorn their idols with the nuts; if a woman wears them in her hair or on her neck it is a sign that she is public." The nuts are distributed along with sugar cakes at marriages (see cocoa-nut); when wrapped in the leaves of the *Piper Betle* or *pán*, along with lime and spices, they form the *bira* or *vira*, which is so much used by the natives of all parts of India, and is commonly presented by one to another in token of civility or affection. They are also given in confirmation of a pledge, promise, or betrothal, and among the Rajpoots are sometimes exchanged as a challenge: thus the expression *bira uthâna* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dálna*, "to propose a premium," for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "*Vetalapanchavinshati*," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree nourishing himself with smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pán ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not an easy matter. The nut is also a constant offering to the gods at Hindoo temples, and on grand occasions the *bira* is covered with gold or silver leaf.

The betel-nut is mentioned in Chinese works written before the Christian era under the name of *Pin-lang*, by some supposed to be a corruption of the Malay name *Pinang;* but

Bombelon (*Pharm Journ.* [3], xvi., 838) was the first to announce that it contained a liquid volatile alkaloid, the properties and composition of which, however, he did not describe. As it seemed probable that the physiologically active constituent was to be looked for in this alkaloid, Herr Jahns was induced to investigate the subject more closely (*Berichte*, xxi., 3404). From his investigation it is clear that an alkaloid *arecoline* is the most active constituent of the nut. Its physiological action has been studied by Dr. Maumé of Göttingen (*Pharm. Zeit.*, Feb. 9, 1889, p. 97), who used for this purpose the hydrobromide and the hydrochloride, of which subcutaneous or intravenous injections were made, or sometimes the solution was applied to the conjunctiva. It was found that full-grown rabbits died within a few minutes after the subcutaneous injection of 25 to 50 milligrams, but recovered after 10 milligrams. Cats succumbed after the administration similarly of 10 to 20 milligrams, only the course of the poisoning was somewhat more prolonged. Dogs, even small animals of 5 to 6 kilograms body-weight, although strongly poisoned by the subcutaneous injection of 50 to 55 milligrams, were not always killed.

The symptoms of poisoning which were observed corresponded in many respects with those seen by Schmiedeberg in his investigation of muscarine, and further, when lethal doses were not used, they could be neutralized by means of atropine sulphate; eventually, however, they presented characteristic differences. The most dangerous action of arecoline consists in the slowing of the heart's action by small doses, or even its stoppage, just as takes place with muscarine; but the latter works in smaller doses, and it is only after somewhat larger doses of arecoline that the ventricle of the frog stops in diastole, or is so influenced that it is not emptied, and only after long intervals makes a weak undulatory muscular contraction. Subsequent injection of atropine removes this action upon the heart. Simultaneously with the heart's action the respiration is also affected. Small doses cause a considerable increase in the number of inspirations; larger doses cause a slower action

with intensified expiration; and very large doses rapidly stop the breathing, especially in cats. After introvenous injection of a lethal dose the respiration usually ceases before the action of the heart.

The subcutaneous injection of 50 to 70 milligrams of arecoline salts into dogs of 4 to 5 kilograms body-weight, besides strong irritation of the heart, gives rise to tetanic cramps, which quickly give place to a partial paralysis.

As a rule, however, the animals overcome the effects of such doses, the heart resuming its action completely as the effects pass off, but it becomes again affected through vomiting and liquid evacuations in which sometimes also worms are brought away. An increased peristaltic action of the bowels is, however, provoked in rabbits, dogs, and cats by much smaller doses.

Intense poisoning of dogs, rabbits, and cats with arecoline may also be accompanied with so strong a contraction of the pupils of both eyes, that in dogs and rabbits they do not show larger than the head of a good-sized pin, whilst in cats they are reduced to a mere streak. Instillation of arecoline solution in an eye gives rise also to a strong one-sided narrowing of the pupil, but the quantity required is so large that the production of myosis in one eye may induce a flow of saliva in rabbits, and affect the heart and respiration in cats. For this reason the action of arecoline upon the human iris has not yet been tested.

It is in accord with observations made during the experiments on animals that the organism may become gradually tolerant to the poison of areca nut, as in the case of tobacco. In the opinion of Dr. Maumé, the physiological experiments indicate that the nut may prove a valuable article of the Materia Medica, since there can be no doubt that arecoline hydrobromide is capable of being utilized therapeutically on account of its effect on the peristaltic action of the bowels and also in suitable combination as a cardiac remedy. Of the other alkaloids which have been separated from areca nut, *choline*

is a natural constituent of the brain-substance, and *arecaine* comes near to the trigonelline of fœnugreek. (*Pharm. Journ.*, Feb. 23, 1889.)

Description—The betel-nut has the shape of a very short, rounded cone, scarcely an inch in height; it is depressed at the centre of the base. The testa, which seems to be partially adherent to the endocarp, is obscurely defined, and inseparable from the nucleus. Its surface is marked with a network of veins, running chiefly from the hilum; these veins extend into the white albumen, giving the seed a strong resemblance to a nutmeg. The small conical embryo is situated at the base. The ripe nut is feebly astringent. Caustic lye turns the brown portion red.

Chemical composition.—The nut contains about 15 per cent. of tannin substance, and 14 per cent. of fat, colouring matter, &c. (*Pharmacographia.*) In the preparation of the bases Herr Jahns adopted two methods, which gave equally good results. According to one, the powdered seeds were exhausted three times with cold water, to which strong sulphuric acid had been added in the proportion of two grams to each kilogram of the seeds; the pressed and filtered extracts were evaporated to about the weight of the raw material used, and after cooling and again filtering precipitated with potassium-bismuth iodide and sulphuric acid. An excess of the precipitant had to be avoided, since it exercises a solvent action on the separated double salt. The red crystalline precipitate was after some days filtered out, washed and decomposed by boiling with barium carbonate and water; the alkaloids went completely into solution, whilst bismuth oxyiodide, colouring matter, &c., remained undissolved. After filtration the alkaloidal solution was evaporated to a small volume, treated with sufficient caustic baryta, and shaken repeatedly with ether, which removed a base that has been named "arecoline," on account of its oil-like character. The residual liquid, which, beside alkaloidal hydriodides, contained some barium iodide, was neutralized with sulphuric acid, and the alkaloids were set free by treatment successively with

silver sulphate, caustic baryta and carbonic acid. The solution of the pure alkaloids was evaporated to dryness and the residue exhausted with cold absolute alcohol (or chloroform). "Arecaine" remained undissolved, whilst a third alkaloid, together with colouring matter, &c., went into solution, and upon evaporation of the alcohol remained as an amorphous mass.

According to the second method, the powdered areca nuts were exhausted cold with milk of lime, the filtered extracts neutralized with sulphuric acid and evaporated to a syrupy consistence. By dissolving in a little water and filtering, the gypsum and separated colouring matter were removed; the solution was then again concentrated, made alkaline, and the arecoline shaken out with ether. The other bases were then precipitated as before with potassium-bismuth iodide and sulphuric acid.

The yield of arecoline amounted to 0·07, or at most 0·1 per cent., that of arecaine to 0·1 per cent., and that of arecaidine to 0·1 per cent.

Arecoline, $C^8H^{13}NO^2$, was withdrawn from the ether solution obtained as described by shaking it with acidulated water, the neutralized liquid evaporated to a small volume, and after adding sufficient potash solution again shaken out with ether. The base left upon evaporation of this solution was neutralized with hydrobromic acid, and the dried salt perfectly purified by repeated recrystallization from absolute alcohol. From this purified compound the free base and other salts of it are prepared.

Arecoline forms a colourless oily liquid of strongly alkaline reaction, which is soluble in all proportions in water, alcohol, ether, and chloroform. It is volatile and can be distilled, the boiling point being 209°C. The salts are easily soluble, some of them deliquescent, but mostly crystallizable. It gives with potassium-bismuth iodide a pomegranate-red precipitate, consisting of microscopic crystals (a delicate reaction), and with phosphomolybdic acid a white precipitate. Potassium-mercury iodide throws down from solutions not too dilute yellow oily drops, which after several days solidify and crystallize; solution

of iodine throws down brown drops, and picric acid a resinous precipitate that afterwards crystallizes in needles. Gold chloride also throws down oily drops, which, however, do not solidify. Platinic chloride, mercuric chloride, and tannic acid give no precipitates.

Arecaine ($C^7H^{11}NO^2 \cdot H^2O$), purified by repeated crystallizations from 60 per cent. alcohol, forms colourless crystals, permanent in the air, freely soluble in water and in dilute alcohol, less soluble in stronger and nearly insoluble in absolute alcohol, by which it is dehydrated. It is also insoluble in ether, chloroform, and benzol. The aqueous solution is neutral in reaction, and has a slightly perceptible weak saline taste. At 100°C. arecaine loses its water of crystallization, melts with frothing at 213°C., and carbonizes when more strongly heated. In a solution acidulated with sulphuric acid potassium-bismuth iodide produces an amorphous red precipitate that very quickly becomes crystalline. Potassium-mercury iodide is far less delicate; it does not precipitate the (neutral) solution of the free alkaloid, but if this be acidified the double salt separates in yellow needles, or at first as an oily precipitate that quickly crystallizes. Potassium iodide also fails to affect a neutral solution, but upon acid being added dark-coloured needles separate. Phosphomolybdic acid, as well as tannic acid, give a slight turbidity; picric acid gives no precipitate, and gold chloride and platinic chloride precipitate crystalline double salts from solutions that are not too dilute.

Arecaine combines with acids to form crystalline salts, having an acid reaction, freely soluble in water and less soluble in alcohol.

Arecaidine, $C^7H^{11}NO^2H^2O$, isomeric with arecaine, forms colourless, permanent, tabular crystals, and is easily soluble in water and dilute alcohol, but almost insoluble in absolute alcohol, ether, chloroform, and benzol; it loses its water of crystallization at 100°C., and melts, attended with frothing, at 222-223°C.; it forms crystallizable salts and is precipitated by platinic and auric chlorides. Arecaine and arecaidine are

easily separated by treatment with methyl-alcohol and hydrochloric acid, whereby arecaidine is converted into its methyl ester, arecoline, and arecaine into the hydrochloride.

Herr Jahns (*Berichte*, xxiv., 2615) describes a fourth crystalline alkaloid in areca nuts, to which he gives the name *Guvacine*, from *guváka*, a Sanskrit name for the areca palm. Guvacine is less soluble in water or dilute alcohol than the other alkaloids, crystallizes in small shining crystals that darken at 265°C. and melt at 271-272° with decomposition. The crystals contain no water of crystallization, and upon analysis yield results corresponding to the formula $C^6H^9NO^2$. Of the salts, the hydrochloride, sulphate, nitrate, platino-chloride $(C^6H^9NO^2 \cdot HCl)^2 \cdot PtCl^4 + 4H^2O$, and auro-chloride, $C^6H^9NO^2 \cdot HCl \cdot AuCl^3$, have been prepared and crystallize well. It therefore appears that a series of bases occur in the areca nut, which, with the exception of choline, stand in near relation to each other—

Choline $C^5H^{13}NO^2$ Arecaine $C^7H^{11}NO^2 + H^2O$
Guvacine $C^6H^9NO^2$ Arecaidine $C^7H^{11}NO^2 + H^2O$
Arecoline $C^8H^{13}NO^2$

Probably other members of the series may be found by examination of a larger quantity of material. (*Pharm. Ztg.*, 1891, 516; *Pharm. Journ.*, Oct. 3, 1891.)

Toxicology.—Cases of poisoning from eating fresh betel-nuts or the poisonous nuts by mistake, not unfrequently occur, but we have not heard of any fatal termination after such accidents. The remedies used are acid pickles and copious draughts of cold water. The sufferers complain of great oppression in the chest, with a sense of faintness and suffocation, sometimes followed by vomiting. According to Maumé, arecoline separates unaltered with the secretions and excretions, from which it can be recovered. In the absence of a characteristic colour reaction, arecoline separated from urine can only be identified chemically by its behaviour with potassium-bismuth iodide, and physiologically by its action upon the heart of a curarized frog.

Commerce.—Some idea of the consumption of betel-nut in India may be formed from the fact, that in addition to her own produce India imports about 30,500,000 pounds of the nut, value about 34 lakhs of rupees, from Ceylon, the Straits Settlements, and Sumatra. The exports are under 500,000 lbs. which go to Eastern countries frequented by Indians, such as Zanzibar, Mauritius, Aden, China, &c. Bombay is the chief centre of the export trade.

The coasting trade statistics show a total of about 44,000,000 lbs., value about 55½ lakhs of rupees, passing from port to port. Bengal, Madras, and Goa are the chief producing provinces. The exports by land beyond the frontier are very trifling, about 1,000,000 lbs. going to Nepal and Bhutan.

The varieties of the nut met with in trade are numerous; they may be classed as natural and artificial: the first class includes the different varieties of ripe betel-nut produced by cultivation which have not undergone any preparation; the second class, all nuts, ripe or unripe, which have been treated by boiling or other processes before being offered for sale.

CALAMUS DRACO, *Willd.*

Fig.—*Blume in Rumphia, ii., tt.* 131-132.

Hab.—Indian Archipelago. The resin (Dragon's blood).

Vernacular.—It is known by the same names as the gum of *Dracæna Cinnabari* (p. 504).

History, Uses, &c.—The original Dragon's blood of commerce was not derived from this plant. The older writers upon Eastern commerce speak of Dragon's blood as an export to the East from Arabia and Socotra. Ibn Batuta, who visited Java and Sumatra between 1325 and 1349, makes no mention of this substance among the products of those islands. Barbosa, writing in 1514, speaks of Dragon's blood as a product of Socotra, but makes no mention of it amongst drugs found in Malacca, Java, Sumatra, or Borneo. (*Pharmacographia.*) Rumphius is the first who describes the mode of preparation followed

at Palembang to procure this drug. It appears that the resin exudes in abundance from the fruit, and, being very brittle, is easily detached by shaking and friction; finally it is exposed to a heat sufficient to make it form a uniform mass. An inferior quality is said to be extracted from the crushed fruit by boiling.

This drug is not mentioned by Indian writers on Materia Medica, but it is now frequently supplied by native druggists, and their customers probably do not distinguish it from the genuine article.

Description.—Lump Dragon's blood only is imported into Bombay from the East: it occurs in large blocks of irregular form; it differs from Socotra Dragon's blood in containing remains of the fruit and numerous scales. Its fracture is somewhat porous, but in good samples the colour is nearly as brilliant as that of the drops from Socotra.

Chemical composition.—A very complete investigation of the properties of the various kinds of Dragon's blood has been made by Messrs. Dobbie and Henderson. (*Pharm. Journ.*, Nov. 10th, 1883.) They say: "Our results may be summed up as follows:—There are at least four distinct kinds of red resin presently sold as Dragon's blood, or labelled in collections under that name. One variety is brick-red in colour, melts at about 80°C., gives off red-coloured highly irritating fumes when decomposed by heat, dissolves readily with an orange-red colour in alcohol, ether, chloroform, carbon bisulphide and benzene, is insoluble or only slightly soluble in cold caustic soda, ammonia, lime water and sodium carbonate, and dissolves with difficulty when boiled in these reagents. Its alcoholic solution has an acid reaction and gives a brown-red coloured precipitate when mixed with a solution of lead acetate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is undoubtedly the resin of *Calamus Draco*, some of the specimens which were examined having their origin well authenticated.

"A second variety is of a beautiful carmine-red colour, melts about 100° C., gives off non-irritating fumes when decomposed

by heat, dissolves freely with a pink colour in alcohol, ether and chloroform, but is insoluble in carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia and sodium carbonate, and much more readily than the foregoing in lime water. Its alcoholic solution has an acid reaction and gives a lilac-coloured precipitate with lead acetate. Its composition may be represented by the formula $C^{17}H^{19}O^{5}$. The source of this resin is quite uncertain. We have no means of determining whether it is identical with any hitherto described variety of red resin. The specimens examined are marked as having come from the Dutch East Indies, but beyond this we know nothing of their origin.

"A third variety is of a vermilion colour, melts about 80°C., gives off aromatic irritating fumes when decomposed by heat, dissolves with a blood-red colour in alcohol and ether, but is insoluble in chloroform, carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia, lime water and sodium carbonate. Its alcoholic solution has an acid reaction and gives with lead acetate a mauve-coloured precipitate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is the resin from a species of *Dracæna*. One of the specimens examined is from *Dracæna Cinnabari*, Socotra, and as it was gathered by Professor Balfour there can be no doubt as to its origin. Another specimen is from *Dracæna Draco*, and its origin is also well authenticated. The other specimens examined are marked some of them *Calamus*, but there can be little doubt that this is a mistake, and that all the resins having the properties just enumerated are derived from species of *Dracæna*. It seems certain then that the resin derived from *Dracæna* is totally different in property from that derived from *Calamus*.

"The fourth variety is a mixture, in varying proportions, of a reddish-brown coloured resin, freely soluble in carbon bisulphide, and a light brick-red coloured resin, nearly insoluble in carbon bisulphide. The two portions also differ considerably as regards their solubility in ether, benzene, and other reagents, the dark portion being in all cases the less soluble of

the two. Since, however, it dissolves to a slight extent in all reagents, we found it impossible to effect a complete separation of the two portions. The portion freely soluble in carbon bisulphide is probably identical with the resins of our first class, while the other portion seems to be a distinct resin.

"Much discussion has taken place with regard to the presence of a volatile acid in Dragon's blood. It seems certain that none of the varieties of this resin contain benzoic acid; at all events we failed to obtain an extract from any of them with petroleum ether, in which benzoic acid is freely soluble. We tested for cinnamic acid by sublimation, and found it present in the resins of the first and third classes, but not in those of the second and fourth classes. To ascertain the delicacy of this method we made a preliminary experiment with artificial mixtures containing 1 per cent. of cinnamic acid, and found that the acid could be separated out by sublimation from very small quantities of such a mixture. Probably the error as to the presence of benzoic acid arose through confounding it with cinnamic acid, or possibly from working with a resin in which benzoic acid had been formed by partial oxidation."

PANDANACEÆ.

PANDANUS ODORATISSIMUS, *Linn. f.*

Fig.—*Roxb. Cor. Pl. i., tt.* 94—96. Screw Pine, Kaldera bush (*Eng.*), Pandan odoriferante (*Fr.*).

Hab.—India, Persia, Arabia. The stems, male inflorescence and seeds.

Vernacular.—Keora (*Hind.*), Keya (*Beng.*), Kevada (*Mar.*), Kevado (*Guz.*), Tázhan-chedi (*Tam.*), Mogali-chettu, Gájangi (*Tel.*), Tázha, Kaita (*Mal.*), Tále-mara, Kyádage-gida (*Can.*).

History, Uses, &c.—The Ketaka or Dhúli-pushpika "dust flower," whose golden spikes of flowers are said to atone

for all its defects, is a great favourite with Vishnu and Krishna, and its flower-leaves are much worn by women in their hair. The poets also celebrate its perfume. In the play of Malati and Madhava, the latter says:—

> The slowly rising breezes spread around
> The grateful fragrance of the Ketaka.

A strophe quoted by Böhtlingk (*Indische Sprüche*, i., 2083) says:—The drunken bee mistakes the golden flowers of the Ketaka for a lotus, and blinded by desire rushes into the flower and leaves his wings behind him. In the Gita Govinda, the bracts are likened to a lance fit to pierce the hearts of lovers, and the opening buds of the Jasmine are supposed to be impregnated by its pollen.

The defects of this plant are described as its crookedness, abundance of thorns (suchi-pushpa), and the desert places which it selects for a habitation. The Ketaka is obnoxious to Siva, and the following story is told to account for his hatred of the tree: Gambling with Parvati he is said to have lost everything he possessed, even to down the clothes upon his back. In a fit of repentance he wandered away and was lost to his friends, who afterwards discovered that he had retired into a forest of Ketaka trees and had become an ascetic. Parvati, having assumed the form of a Bhil damsel with Ketaka in her hair, followed him into the forest, and having succeeded in making him break his vow afterwards upbraided him for inconstancy; whereupon he cursed the Ketaka and any one who should offer its flowers at his shrine. This episode is the subject of a well-known Marathi *luoni*:—

> Siva sáthi jhali bhilina
> Jaga mohini Girja jhali udása.

> Unhappy Girje, erst the world's ador'd
> A gipsy maid now, seeks for Shiv her lord.

According to the Nighantás, the plant has bitter, sweet, light, and pungent properties, and removes phlegmatic humors.

In Persia it is called Kádi, Gulkiri, and Gul-i-kabadi; the Arabs call it Kádi and Kadar. Rázi recommends it in leprosy

and small-pox; it is considered by Mahometan physicians to be cardiacal, cephalic, and aphrodisiacal. They prepare a *sharab* by boiling the pounded stems in water, also a distilled water from the flowering tops and a perfumed oil. Mir Muhammad Husain states that the Hindus believe that if these preparations are used when small-pox is prevalent, the disease will be averted, or be of so mild a form as to be free from danger. The ashes of the wood are said to promote the healing of wounds, and the seeds to strengthen the heart and liver.

In India the perfumed oil is prepared by placing the floral bracts in sesamum oil and exposing it to the sun for forty days; fresh bracts are supplied and the old ones removed several times during this period. This oil is much valued as a perfume, and is used as a remedy for earache and suppuration of the meatus. The distilled water may be simple or compound; in the latter case the bracts are distilled with rose-water or sandalwood chips; it is used as a perfume and to flavour sherbets.

The leaves of several species of Pandanus are used for making mats and to polish lacquer-ware, and the fruit has been eaten in famine times. The edible species (*P. edulis, Thonars*), common in Madagascar and the islands of the South Pacific, does not occur in India. The aerial roots of the different species are much used to make coarse brushes in the East, a portion of the desired length being cut and the end beaten until the fibres separate.

Description.—The male inflorescence is a large, terminal, pendulous, compound, leafy panicle, the leaves of which are yellowish-white, linear-oblong, pointed and concave, the margins being armed with very fine sharp spines; in the axil of each there is a single thyrse, composed of simple, small racemes of long, pointed, depending anthers, which are not sessile, but raised from the rachis of these partial racemes by tapering filaments. The fruit is compound, oval, from six to eight inches in diamater, and from six to ten long, weighing from four to eight pounds, rough, of a rich orange colour, composed

of numerous, wedge-shaped, angular drupes; when ripe their large or exterior ends are detached from one another, and covered with a firm, orange-coloured skin; apices flat, consisting of as many angular, somewhat convex tubercles as there are cells in the drupe, each crowned with the withered stigma, internally the exterior half of these drupes next the apex consists of dry spongy cavities, their lower part, next the core or common receptacle, is yellow, consisting of a rich-looking, yellow pulp, intermixed with strong fibres; here the nut is lodged. Nut of each drupe compound, turbinate, exceedingly hard, angular, containing as many cells as there are divisions in the apex of the drupe; each cell is perforated above and below. Seeds single, oblong, smooth, adhering lengthwise to a small fasicle of strong white fibres, which pass through the perforations of the cell. (*Roxburgh.*)

TYPHACEÆ.

Typha angustifolia, *Linn., Eng. Bot.* 1456. *Vern.*—Rámabána. The soft woolly inflorescence of the male spadix is applied like cotton to wounds and ulcers. The plant is abundant on the banks of the Indus, where it is called "Pun." From the pollen is made the Búr or Búratú, much eaten by the natives of Sind. The Sanskrit name is Eraka.

Description.—Perennial, culms straight, 6 to 10 feet high, round, smooth, jointed at the insertion of the leaves; leaves long, ensiform, obtuse, flat on the inside, as long or nearly as long as the stem, about 3 to 4 inches broad; sheath smooth, embracing the culms; male catkin 2 to 3 inches above the female, cylindric, 8 to 10 inches long, densely covered with stamens, and numerous 3 to 4 cleft fine filaments, each with 2 to 3 anthers; anthers linear; female catkin 8 to 10 inches long; glume with fine filaments.

AROIDEÆ.

ACORUS CALAMUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 279; *Rheede, Hort. Mal. xi.*, *t.* 48. Sweet-Flag (*Eng.*), Acore vrai (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The rhizome.

Vernacular.—Bach, Gora-bach (*Hind.*, *Beng.*), Vekhand, Gora-bach (*Guz.*), Vekhand, Bál-vekhand (*Mar.*), Vashambu (*Tam.*), Vasa (*Tel.*), Vashanpa (*Mal.*), Vajé (*Can.*).

History, Uses, &c.—This plant bears the Sanskrit names of Vachá "talking," Shadgrantha "six-knotted," Ugragandha "strong smelling," Jatilá "having entangled hair," &c., and is described in the Nighantás as hot, pungent, bitter, stomachic and emetic; useful for clearing the voice by removing phlegm, and in colic. As an emetic it is administered in doses of about 80 grains with half a *sér* of tepid salt water; in dyspepsia it is given in combination with asafœtida, long pepper, black pepper, ginger, chebulic myrobalans, *sonchal* salt, and the tubers of *Aconitum heterophyllum*, of all equal parts, in doses of half a drachm. As a stimulant or nervine it is used in combination with other remedies in low fevers, epilepsy, and insanity. The authors of the *Pharmacographia* remark—"The descriptions of *Acoron*, a plant of Colchis, Galatia, Pontus, and Crete, given by Dioscorides and Pliny, certainly refer to this drug." The Arabian physicians also agree in identifying it with the *Acoron* of the Greeks, a name probably derived from the Persian *Agar*. Ibu Sina describes the drug under the name of Waj, and quotes Galen with regard to its properties, and all the Arabian and Persian physicians reproduce what Dioscorides has written concerning ακόρον. That this plant is not the *Calamus aromaticus* of the ancients appears to be evident, as Pliny describes both *Acoron* and *Calamus aromaticus*. The Arabians also do not identify the plant with *Calamus aromaticus*, but describe the latter under the name of Kasab-ed-darira and

identify it with *Swertia Chirata.* Hájá Zein states that in his time (1368) Kasab-ed-darira came from Calicut, where it was called by the natives *Báringa;* if this statement is correct, the drug used by him must have been either *Premna herbacea* or *Clerodendron serratum,* the Bháringa of the Hindus. Royle supposes *Calamus aromaticus* to have been an Andropogon. Mahometan writers describe it as deobstruent and depurative, useful for the expulsion of the phlegmatic humours, which they suppose to be the cause of paralysis, dropsy, and many other diseases; they recommend it to be given to children to bite when teething, and prescribe it internally in calculous affections. It has also a reputation as a diuretic, emmenagogue, and aphrodisiac, and is applied in the form of poultice to paralysed limbs and rheumatic swellings. A pessary composed of Acorus, saffron, and mare's milk is used to promote delivery; a hip bath of the decoction is also said to be efficient for this purpose. Dr. Ondaatji, Colonial Surgeon of Ceylon, has brought to notice the use of sweet-flag as an anthelmintic in that island. He says: "An infusion of the rhizome given to young children acts effectually, as I have seen many such cases treated among the natives." Dr. Evers at the Seoni Main Dispensary has found the drug very effectual in dysentery. He uses the following decoction:—Bruised rhizome 2 ozs., Coriander 1 dr., Black pepper ½ dr., Water one pint. Boil down to 12 ounces, and let cool. Dose for an adult 1 ounce three times a day; for a child 1 to 3 drachms, sweetened with sugar, two or three times a day. He also remarks:—"The decoction is not only useful in dysentery and diarrhœa, but also in the bronchitic affections of children." I have often taken it myself when suffering from a bad cold in the chest. (*Ind. Med. Gazette,* Feb. 1875.)

The evidence collected by Dr. Watt for *Dict. Econ. Prod. of India* testifies to the value of Acorus as an aromatic bitter and stimulant, especially useful in allaying distressing cough.

Description.—The root-stock occurs in somewhat tortuous, sub-cylindrical or flattened pieces, of variable length; to

the upper surface of these is attached the lower portion of the leaves which have been cut off; on the under surface may be seen a zigzag line of little elevated dot-like rings, the scars of roots. The root-stock is usually rough and shrunken, varying in colour from dark-brown to orange-brown, breaking easily with a short corky fracture, and exhibiting a whitish spongy interior. The odour is aromatic and agreeable; the taste bitterish and pungent. The Persian variety of Acorus is darker in colour when fractured and has a more powerful odour, the leaves have been entirely removed, instead of being cut off short.

Microscopic structure.—A section of the rhizome is like an open network composed of rows of nearly round cells and open spaces (water passages); most of the cells contain small starch granules, but some of them essential oil; at the junction of the cortical and central portions of the rhizome is a very distinct row of small empty cells. The vascular bundles are numerous, especially just within the line of small cells just noticed; each bundle consists of a ring of spiral vessels surrounding a number of jointed tubes.

Chemical composition.—The authors of *Pharmacographia* say:—"The dried rhizome yielded us 1·3 per cent. of a yellowish neutral essential oil of agreeable odour, which in a column of 50 mm. long deviates the ray of polarized light 13·8° to the right. By working on a large scale, Messrs. Schimmel & Co., of Leipzig, obtained 2·4 to 2·6 per cent. According to Kurbatow (1873), this oil contains a hydrocarbon, $C^{10}H^{16}$, boiling at 159° C., and forming a crystalline compound with HCl, and another hydrocarbon boiling at 255—258° C., affording no crystallizable hydrochloric compound. By submitting the oil to fractional distillation, we noticed, above 250°, a blue portion, which may be decolourized by sodium. The crude oil acquires a dark-brownish colour on addition of perchloride of iron, but is not at all soluble in concentrated potash solution.

The bitter principle, *Acorin*, was isolated by Faust in 1867, as a semi-fluid, brownish glucoside, containing nitrogen, soluble

both in ether and in alcohol, but neither in benzol nor in water. In order to obtain this substance, we precipitated the decoction of 10 lbs. of the drug by means of tannic acid, and followed the method commonly practised in the preparation of bitter principles. By finally exhausting the residue with chloroform, we succeeded in obtaining a very bitter, perfectly crystalline body, but in so minute a quantity that we were unable to investigate its nature." (*Op. cit.*, 2nd Ed., p. 678.)

Herr Thoms (*Archiv. der Pharm.* [3] xxiv., p. 465) announced the absence of nitrogen in acorin, which is contrary to the results obtained by Faust; at the same time this author states that under the influence of acids and alkalies, or of emulsin, acorin splits up into sugar and carburet of hydrogen, and that it readily oxidizes and is converted into a resinous substance *acoretin*, which, when reduced from alkaline solution by nascent hydrogen, gives an essential oil and sugar as final products.

The fact of a glucoside behaving in this way being inadmissible has led M. Geuther to make a fresh examination of acorin, which he obtained by exhausting the root with cold water and separating the acorin by means of animal charcoal; the impure acorin was then removed from the charcoal by means of alcohol, and, after purification, was found to contain 3·2 p. c. of nitrogen, 70·0 of carbon, and 9·1 of hydrogen. Treated with a boiling dilute solution of soda it yielded no sugar, but was converted into an acid substance which strongly reddened litmus; treatment with dilute acids also yielded no sugar. Exhausted by soda, the bitter matter has the formula $C^{80}H^{67}NO^{14}$, and the acid which has been yielded to the alkali has the formula $C^{22}H^{18}O^{6}$; treated with hydrochloric acid it sets free an acid of the formula $C^{22}H^{16}O^{3}$ or $C^{22}H^{18}O^{3}$, which appears to be a product of the oxidation of the free acid already noticed. M. Geuther considers that the acoretin of Herr Thoms is nothing but impure acorin. (*Annalen der Chem.*, ccxl., p. 92.)

SCINDAPSUS OFFICINALIS, *Schott.*

Fig.—*Wight, Icon., t.* 781.

Hab.—Bengal. The fruit.

Vernacular.—Gaj-pipli, Bari-pipli (*Hind.*), Gaja-pipal (*Beng.*), Atti-tippili (*Tam., Mal.*), Enuga-pippallu (*Tel.*), Dodda-hipalli (*Can.*), Thora-pimpali (*Mar.*), Motho-pimpali (*Guz.*).

History, Uses, &c.—The ripe fruit of this plant is the true Gaja-pippali of the Nighantás; it also bears the Sanskrit names of Kari-pippali, Kapi-valli, Kota-valli, Shreyasi, and Vashira. It is described as aromatic, carminative, stimulant, and useful in diarrhœa, asthma, and other affections supposed to be caused by deranged phlegm. In practice it is generally used as an adjunct to other medicines. *S. officinalis* is cultivated in Bengal, chiefly in the Midnapore district, and the fruits, cut into transverse pieces and dried, form the Gaja-pipal of the druggists of Eastern and Southern India.

In Northern and Western India an entirely different drug is sold under the same name; it consists of the entire plant of a Balanophora often remaining attached to a small piece of the dead stick upon which it grew. The largest of these plants are about five inches in length, and consist of a kind of cellular cup, from which springs a scaly spadix surmounted by a glandular-shaped club of imperfect flowers, beneath which the stem is marked by little pits showing the places where the female flowers were attached. This drug is mucilaginous and astringent, and is no doubt improperly substituted for the genuine article.

Description.—The fruit of *S. officinalis* occurs in slices an inch or less in diameter and about ¼ inch in thickness, of a greyish colour and almost inodorous. The slices consist of a central core surrounded by the seeds partly enclosed in the dried pulp of the arils; when soaked in water they swell up and soften, and the core may be seen to contain numerous large liber cells very sharply pointed at both ends which act like stinging hairs. The pulp surrounding the seeds is full of needle-like crystals of oxalate of lime, similar to those found in the acrid

corms of other aroids. The seeds are rather larger than hemp seeds, kidney-shaped, grey and polished; they contain a white oily kernel.

Chemical composition.—With the exception of a minute trace of an alkaloid, nothing of special interest was detected. The mucilage afforded jelly-like precipitates with plumbic acetate and ferric chloride. No tannin was present. Ash, 14·6 per cent.

Scindapsus pertusus, *Schott., Rheede, Hort. Mal. xii., tt.* 20, 21, is a large perennial plant, running over trees and rooting on them like Ivy; leaves alternate, resembling those of the Pipal (*Ficus religiosa*) but larger, often perforated and cut in the margins; spadices shortly-peduncled; spathe gibbous, acute, a little longer than the spadix; spadix cylindric-obtuse. The juice of the plant with black pepper is given to people who have been bitten by the *Kusriya Ghanas*,* a snake so called because the part bitten by it mortifies. The juice, with that of the roots of *Croton oblongifolium* and of the fruit of *Momordica Charantia,* is also applied to the bitten part.

ALOCASIA INDICA, *Schott.*

Fig.—*Wight Ic., t.* 794.

Hab.—India, cultivated in Bengal and elsewhere. The root-stock.

Vernacular.—Mánkand, Kachu (*Hind.*), Mán-kachu (*Beng.*), Kás-alu (*Mar.*).

History, Uses, &c.—This large Arum is the Mánaka of Sanskrit writers; its root-stock is a valuable and important article of diet in Bengal, and often grows to an immense size, being from six to eight feet in length, and as thick as a man's leg. When dried it can be kept for a considerable time and affords a large supply of starchy food. In Western India it is much cultivated as an ornamental plant in gardens, but is little known as an article of diet; the acrid juice of the petioles is, however, much used as a common domestic remedy

* Daboia Russellii, a viper.

on account of its styptic and astringent properties. The petiole is slightly roasted and the juice expressed. We have seen purulent discharge from the ears in children stopped by a single application. The tubers chopped fine, tied in a cloth and heated, are used as a fomentation in rheumatism.

Medicinally *mánaka* is said to be useful in anasarca, in which disease it is used in the following manner. Take of the meal of the root-stock eight tolás, rice-meal sixteen tolás, water and milk forty-eight tolás each; boil them together till the water has evaporated. This preparation is called *Mána-manda*, and is given as an article of diet to the patient, nothing else being allowed during its administration except milk. (*Chakradatta.*)

As a vegetable, the root-stock is peeled, cut in small pieces and well boiled to remove its acridity; it is then mixed with other vegetables and cooked with the usual condiments. Dr. D. Basu (*Dict. Econ. Prod. Ind.*, i., 178) remarks—"I have never used it solely as a medicine; but as food taken frequently, it seems to act as a mild laxative and diuretic. In piles and habitual constipation it is useful." Surgeon-Major R. S. Dutt (*idem*) states that it is a very agreeable vegetable during convalescence of natives from bowel complaints; it is light and nutritious and somewhat mucilaginous. The ash of the root-stocks mixed with honey is a popular remedy for aphthæ.

Description.—The root-stock occurs in large round pieces, a foot or more in length, and covered externally by the brown dried remains of the leaf petioles and their sheaths. Internally it is white, opaque, and starchy, and when fresh has an acrid odour which is lost on drying. Pulped and washed it yields a large quantity of pure white starch.

Chemical composition.—The acridity of this plant has been shown by Pedler and Warden (*Jr., Asiatic Soc., Bengal*, Vol. LVII., Part II.) to be due to the large number of acicular crystals of oxalate of lime contained in its tissues.

AMORPHOPHALLUS CAMPANULATUS,

Blume.

Fig.—*Roxb. Cor. Pl. iii., t.* 272; *Bot. Mag., t.* 2812; *Wight Ic.*, 785.

Hab.—India. Much cultivated. The tubers.

Vernacular.— Jimi-kand (*Hind.*), Ol (*Beng.*), Surana (*Mar., Guz.*), Suranu (*Can.*), Karunai-kizhangu (*Tam.*), Kanda-godda (*Tel.*), Karuna-kizhanna (*Mal.*).

History, Uses, &c.—This arum occurs as a wild plant on the banks of streams and also in several cultivated forms. It is the Surana and Olla of Sanskrit writers, and among other synonyms bears that of Arsoghna or "destroyer of piles." For medicinal use, Sarangadhara directs the tuber to be covered with a layer of earth, roasted in hot ashes, and administered with the addition of oil and salt. Several confections are also used, such as the *Laghuourana modaka, Vrihat surana modaka, &c.*; these are made of the tubers of the plant with the addition of treacle, aromatics (ginger and pepper) and Plumbago root, and are given in doses of about 200 grains once a day in piles and dyspepsia. The dried tubers of the wild plant, peeled and cut into segments, are sold in the shops under the name of *Madan-mast.* The segments are usually threaded upon a string, and are about as large as those of an orange, of a reddish-brown colour, shrunken and wrinkled, brittle and hard in dry weather; the surface is mammillated. When soaked in water they swell up and become very soft and friable, developing a sickly smell. A microscopic examination shows that the root is almost entirely composed of starch. Madan-mast has a mucilaginous taste, and is faintly bitter and acrid; it is supposed to have restorative powers, and is in much request; it is fried in ghí with spices and sugar. It is interesting to note that the tubers of the greater Dracontia (*Diosc.*, ii., 155) were preserved by the Greeks in the same manner for medicinal use. The cultivated plant is largely used as a vegetable; under cultivation it loses much of its acridity and grows to an enormous size.

Synantherias sylvatica, Schott., is regarded by the Hindus as a kind of wild *Surana*, and, with the wild form of *Amorphophallus campanulatus*, bears the Sanskrit name of Vajra-kanda "thunder-bolt." The country-people use the crushed seed to cure toothache; a small quantity is placed in the hollow tooth and covered with cotton; it rapidly benumbs the nerve; they also use it as an external application to bruises on account of its benumbing effect. In the Concan the seeds rubbed into a paste with water are applied repeatedly to remove glandular enlargements. The fruit is yellow, about the shape and size of a grain of maize, closely set round the upper part of the spike, which is several feet in height, and as large as that of the plantain. The skin of the fruit is tough, the pulp scanty and yellow; it encloses two seeds having the shape of a coffee bean, and placed with their flat surfaces in apposition. The testa of the seed is soft, greenish-brown externally, green internally; the kernel is white, adhering closely to the testa, soft and juicy when fresh, but rapidly becoming hard and dry when cut. The taste is intensely acrid, after a few seconds it causes a most painful burning of the tongue and lips, which lasts for a long time, causing much salivation and subsequent numbness. A section of the fruit and seed show the following structure from without inwards :—1*st*, several rows of thick-walled cells, having yellowish-brown granular contents (skin); 2*nd*, a parenchyma composed of thin-walled cells, having no solid contents except needle-shaped crystals (pulp); 3*rd*, several rows of small cells containing chlorophyll (testa of seed); 4*th*, a delicate parenchyma, the cells of which are loaded with very small starch granules, mostly round, some truncated.

The tubers of *Sanromatum pedatum*, Schott., are very acrid, and are used externally under the names of Bhasamkand and Lót as a stimulating poultice. The plant is extremely common, and its pedate leaves appear with the first rain in June. The flower, which is produced just before the rains, seldom attracts notice, being more or less buried in the soil. The tubers are about as large as small potatoes, and of the same shape as those of the Surana.

CRYPTOCORYNE SPIRALIS, *Fisch.*

Fig.—*Wight Icon.*, *t.* 773.

Hab.—Marshy banks and standing water. Southern India. The rhizome.

Vernacular.—Nattu-ati-vadayam (*Tam.*), Nátti-ati-vasa (*Tel.*).

History, Uses, &c.—The Ati-vadayam of the Tamils is the Atís of Northern India, and is the tuber of *Aconitum heterophyllum*. The country Atís of the Madras Presidency has for a long time been undetermined, until in 1888 Mr. M. A. Lawson was able to refer it to *Cryptocoryne spiralis* and a species of Lagenandra. Moodeen Sheriff says the root bears a strong resemblance externally to Ipecacuanha, and he has used it as a tonic and anti-periodic with children. It attracted attention a few years ago through several packages of it appearing in the London market as "False Ipecacuanha." It is a well-known drug in Ceylon, where it is employed by the native doctors in decoctions in combination with other drugs as a remedy for infantile vomiting and cough, and in the case of adults for abdominal complaints and fever. The Singhalese obtain the drug from India and value it at 4 annas per pound retail.

Description.—Leaves petioled, linear-lanceolate; spathe sessile, much shorter than leaves, twisted; ovary 5-celled. The rhizome is about the thickness of a small quill. The drug appears in broken pieces from ½ to 1½ inch long, annulated, of grey or dark-grey colour externally and white internally, inodorous and acrid in taste.

In the Cryptocoryne the annulations are not so frequent, and the drug is more slender than in the Lagenandra.

Chemical composition.—The drug contains starch and numerous bundles of raphides, but no alkaloidal active principle has been separated.

Lagenandra toxicaria, *Dalz.*, *Rheede, Hort. Mal. xi.*, *t.* 23, is a marsh plant, three feet high, with a thick, creeping,

fleshy rhizome, juicy and white, sending off numerous thick fleshy roots of a white colour. The leaves are on long petioles, oblong, obtuse, entire coriaceous, large; sheaths stipulary, opposite the leaf; scapes axillary, solitary, compressed; spathe longer than the scape, tubular at the base, attenuated into a long, slender apex; fruit compound, about 1 inch in diameter; seeds cylindric-oblong, minute, several in each cell, erect from the base. The plant is a native of Southern India, and is considered to be very poisonous. Rheede says of it:—"Balneum ex hac planta præparatum omnem corporis æstum reficit."

Rheede (xii., 9) states that the root of *Remusatia vivipara*, Máravara Tsjembu (*Mal.*), Rukh-alu (*Mar.*), is made into an ointment with turmeric and used as a remedy for itch, and that the juice with cow's urine is considered to be alexipharmic.

TACCA ASPERA, *Roxb.*

Hab.—Tropical India. The tubers.

Vernacular.—Váráhi-kand (*Hind., Beng.*), Dukar-kand (*Mar., Guz.*), Handi-gadde (*Can.*).

History, Uses, &c.—This plant is the Váráhi-kanda or Súkara-kanda of the Nighantás, so called from its being a favourite food of the wild boar. It is described as sweet, digestive, nourishing and tonic; useful in cachectic affections, such as leprosy, &c. *T. aspera*, *T. lævis*, and *T. pinnatifida* all have tuberous roots, from which a starch resembling arrowroot may be obtained, and all three plants are probably utilized by the herbalists, who usually supply the coarsely prepared starch to their customers.

Description.—The root is an oblong curved tuber, of a middling size, with wiry fibres from its sides; externally of a dark-brown or blackish colour, and internally of a pale yellowish white. It has a bitter, nauseous taste. A full description of

the plant, as well as of the two other species mentioned, will be be found in Roxburgh's *Flora Indica*.

PISTIA STRATIOTES, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 268; *Rheede, Hort. Mal. xi., t.* 32. Water soldier (*Eng.*).

Hab.—Tanks and ponds of India. The whole plant.

Vernacular.—Jal-Kunbhi (*Hind.*), Gondála, Shérval (*Mar.*), Agasatamaray (*Tam.*).

History, Uses, &c.—Amongst the Sanskrit names of this plant we may notice Jalodbhuta, Jalàsaya, Guccha-bodhra, and Paniya-prishthaja "born on the surface of water." This aquatic plant is a native of Asia, America, and Africa; it is considered by the Hindus to be cooling and demulcent, and is prescribed in cases of dysuria in the quantity of about ten pagodas' weight twice daily; the leaves are made into a poultice for the piles. (*Ainslie.*) The ashes are applied to ringworm of the scalp, and in some parts of India are known as 'Páná salt.'

A notice of the plant will be found in Arabic and Persian medical works under its Greek name στρατιώτης.

Description.—Often found floating on stagnant pools, leaves sub-rotund, obcordate, rosulate, waved on the margins, the nerves spreading like a fan, uniting into a truncate arc at the base; spadices axillary, solitary, seated on a short scape.

Chemical composition.—The plant and salt have been examined by Warden of Calcutta, who reports that the weed dried at 130°C. and carbonized yielded 31 per cent. of total ash, of which 6 per cent. was soluble. The sample of "salt" was slightly deliquescent, alkaline in reaction, and had the appearance of dirty common salt. Dried at 130° it yielded 73 per cent. of potassic chloride, 22·6 per cent. of potassic sulphate,

and minute quantities of potassic carbonate, sodic chloride, calcic sulphate, magnesic sulphate, and ferric, aluminic and silicic oxides. (*Chem. News*, March 23, 1883, p. 133.)

DIOSCORINEÆ.

This genus is of much importance as a source of food in India, and some of the species are used medicinally on account of their acrid or bitter properties. In Sanskrit they bear the general name of *alu*, and the different species are distinguished by prefixes, *e.g.*, Madhválu "sweet yam" (*Dioscorea aculeata*), Pindálu "globose yam" (*D. globosa*), Raktálu "red yam" (*D. purpurea*), &c. But the Sanskrit name *alu* is also applied to other plants having tuberous roots, and it is therefore difficult to say what the original meaning of the word may have been. *Dioscorea bulbifera* in its wild state is extremely bitter; the small potato-like tubers on the vine dried and powdered are used as a medicinal application to sores, and are given internally in 4 massa doses with a little cumin and sugar in milk as a remedy for syphilis and for dysentery; the powder made into a bolus with butter is given to check diarrhœa; the roasted tubers of the cultivated variety made into balls with ghí and sugar-candy have a reputation as a remedy for piles: under cultivation the plant loses its bitterness, and is much grown for the tubers which are roasted and eaten.

D. triphylla is very acrid, and its tubers are sometimes used as a plaster to disperse swellings. We have received the tuber of this yam from Burma, where it is used as a poison; when taken internally it causes great irritation in the mouth and throat, vomiting of blood, a sense of suffocation, drowsiness, and exhaustion: and it is said that a piece of the tuber, the size of an apple, is sufficient to cause death in six hours. Nevertheless the Burmese use it as an article of food after it has been cut in thin slices, repeatedly washed, and steamed in an earthen pot. The Burmese name is Choo-ay-oo. In Sanskrit the tuber bears

the name of Pàshpoli "strangle cake." For an account of the economic uses of the different species of Dioscorea cultivated in India, we must refer the reader to the *Dict. Econ. Prod. of India*, iii., p. 115.

The tubers yield a milky juice containing a small quantity of fat, a resin, and caoutchouc. Analysis of tubers—Water 60·722, Ash free from C, CO,* and Si O^2 0·895, Protein compounds 4·485.

The following analyses of *D. alata* and *edulis* are by Payen (*Compt. rendus*, xxv., 1847, and Moser, *Landw. Versuchsst. Bd.*, 20, 1877).

	Dioscorea alata.	D. edulis.
Water	79·64	60·72
Nitrogenous matter	1·93	4·48
Fat	...	0·35
Nitrogen free extractive	17·33	32·47
Cellulose	...	1·09
Ash	1·10	0·89
In dry substances.		
Nitrogen	1·52	1·82
Carbohydrates	...	82·66

The nitrogen-free extractive of *D. alata* contained 4·79 per cent. cane-sugar, ·18 per cent. cellulose, and 25·19 per cent. starch.

CYPERACEÆ.

CYPERUS ROTUNDUS, *Linn.*

Fig.—*Rottl.* 28, *t.* 14, *f.* 2.

Hab.—Throughout India. The tubers.

Vernacular.—Motha (*Hind., Guz.*), Korai (*Tam.*), Bhadra-muste, Tunga-muste (*Tel.*), Bimbal, Bárik-motha (*Mar.*), Mutha (*Beng.*).

History, Uses, &c.—This is the Mustaka of Sanskrit writers; it is considered to be diuretic, diaphoretic, astringent,

and stomachic, and is prescribed in febrile affections and derangements of the bowels. In Indian domestic medicine the fresh tubers are applied to the breast in the form of a paste as a galactagogue.

C. rotundus is doubtless the سعد (Suad) of Abu Hanifeh, who describes it as a certain kind of sweet-smelling root or rhizome (ارومه), round, black, hard like a knot, which is an ingredient in perfumes and medicines. In the *Kámús* it is said to possess a wonderful efficacy for healing ulcers and sores. Ibn Sina says that the best kind of Suad is that which comes from Kufa in Chaldea, and that the Indian drug (*C. scariosus*) is said to make the hair grow thin. He, along with other Arabian and Persian writers, describes the drug as attenuant, diuretic, emmenagogue, lithontriptic, and diaphoretic; they prescribe it in febrile and dyspeptic affections, and in one ounce doses as an anthelmintic; externally it is applied to ulcers, and used as an ingredient in warm plasters.

Dioscorides calls it κύπερος and notices its use as a diuretic and emmenagogue and as an application to scorpion stings and ulcers; he also states that it is an ingredient in warm plasters.

Herodotus (4, 71) notices it as an aromatic plant used by the Scythians for embalming. κύπειρον is mentioned in the Iliad (21, 351) and Odyssey (4, 603) and by Theophrastus in his fourth book; it appears to have been a favourite food of horses. Pliny (21, 18) calls it *Juncus triangularis* or *angulosus*; it is also probably the Juncus of Celsus (3, 21), mentioned as an ingredient in a diuretic medicine for dropsy, although he calls it *Juncus quadratus*.

Description.—Culms erect, 1—2 feet, triangular, with rounded angles; leaves radical; sheathing shorter than the culms; root tuberous, tubers often crowded together, size of filberts, brown or black externally, white internally, odour like that of Acorus; umbels terminal, compound; involucre 3-leaved, unequal; spikes linear, sub-sessile. Often a troublesome weed in cultivated ground.

CYPERUS SCARIOSUS, *R. Br.*

Fig.—*C. B. Clarke, Linn. Soc. Journ. xxi.*, 159.

Hab.—Damp places in Bengal. The tubers.

Vernacular.—Nágar-motha (*Hind., Guz.*), Nágar-mutha (*Beng.*), Laväla, Nágar-motha (*Mar.*), Muttah-kách (*Tam.*), Kola-tunga-muste (*Tel.*), Konnari (*Can.*).

History, Uses, &c.—This plant produces the aromatic tubers which have long been in use in Hindu medicine and perfumery under the Sanskrit name of Nágar-mustaka; they are considered to have the same medicinal properties as those of *C. rotundus.* Arabian and Persian writers mention this Indian Cyperus, but consider it to be inferior to *C. rotundus.* In the Concan, Nágarmoth, *Solanum indicum, Tinospora cordifolia*, Ginger and Emblic myrobalans, of each 2 tolás, are powdered and divided into 5 parts, and one part taken daily in decoction with a little honey and long pepper as a febrifuge. Several other prescriptions of a similar nature are used in fever, and will be found in the *Wanaushádi Prakasha.* In dysentery, Nágarmoth, Mocharas, Lodhra, Daitiphul (*Woodfordia floribunda* flowers), unripe Bael fruit, and the seeds of *Holarrhena antidysenterica* are ground with whey and molasses and given in 6 massa doses. In famine seasons Nágarmoth has proved a valuable resource to the poor.

Description.—The ovoid tubers of this plant are developed upon a thin underground stem, and are simple or branched, generally about 2 inches long and ½ an inch in diameter; the external surface is marked by a number of annular ridges, and is almost concealed by the remains of leaves; when these are removed, the colour of the tuber is a deep brown; a few wiry rootlets arise from its under surface, and at the lower end is a portion of the underground stem. The substance of the tuber is hard and of a reddish colour; it is divided into a central and cortical portion, the latter being of a darker colour. The odour is strongly aromatic like Acorus, but somewhat terebinthinate. The plant is aquatic and grows in the Concan in ponds and

ditches along with *Scirpus subulatus*, Vahl.; both plants are called Lavála in Marathi, a name which appears to be equivalent to the English *Rush*.

Microscopic structure.—The outermost layer of the cortical portion is composed of large bundles of reddish-brown stony cells, separated from one another by interspaces; within it are from 6 to 8 rows of very thick-walled, empty cells; next a tissue of thick-walled cells, most of them full of large starch granules, but some containing essential oil and probably resinous matter. The central portion of the tuber is separated from the cortical by a single row of small yellow stone cells; it is composed of thick-walled cells full of starch like those in the cortical portion, but differs from it, inasmuch as many of the cells contain red colouring matter. Large vascular bundles abound in the root, some of them are surrounded by a layer of stony cells.

Commerce.—Two kinds of Nágarmoth are met with in this market—Surat and Kattiawar; the first is heavier and more aromatic than the second. Value—Surat, Rs. 2 per maund of 37½ lbs.; Kattiawar, Rs. 1¼. The Surat Nágarmoth is probably obtained from Rájputana, where the plant is common in tanks.

Scirpus Kysoor, *Roxb.* *Vern.*—Kasírú (*Hind.*), Kachara (*Bomb.*). The tuberous root found in tanks, about the size of a nutmeg, and of a black colour externally, has astringent properties, and is given in diarrhœa and vomiting.

We have met with two other species of Cyperus, yielding edible tubers. The one, called "Thegi" in Guzrathi, is probably *C. bulbosus*. It grows in the sand on the coast of Kattiawar, and is used as a bread-stuff at all times, and was of much value in the last famine. The tubers are ovoid and pointed, about ½ of an inch in length, horny and translucent, brittle when dry and farinaceous when powdered. The other is called "Pudhya" in Marathi; it grows in salt rice-fields, and is eaten in the Southern Concan. The tubers are half an inch or a little more in length, surface brown, with the remains of membranaceous sheaths arising from four transverse rings, hard, white and mealy within.

The analyses of these tubers gave the following results :—

	Thegi.	Pudhya.
Fat	·73	·65
Sugar, &c. (spirit extract)	·82	1·64
Gum and carbohydrates	9·00	5·69
Albuminous matter	6·68	8·68
Starch	62·99	66·24
Fibre	6·78	4·51
Ash	3·60	2·06
Moisture	10·40	10·53
	100·00	100·00

The amount of nitrogen in the first was 1·07 per cent. and in the second 1·39 per cent. There were traces of an alkaloid in both tubers.

KYLLINGIA MONOCEPHALA, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 53 ; *Rumph. Amb. vi.*, 8, *f.* 2 ; *Rottl. Gr.*, 13, *t.* 4, *f.* 4.

KYLLINGIA TRICEPS, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 52.

Hab.—Throughout the Peninsula of India. The roots.

Vernacular.—Nirbisi (*Hind.*), Sveta-gothúbi, Nirbishi (*Beng.*), Mottenga, Pee-mottenga (*Mal.*), Musta (*Mar.*).

History, Uses, &c.—These plants are the Nirvisha of Sanskrit medical writers, who describe them as antidotal to certain poisons. Rheede describes *K. triceps* and *K. monocephala* as having similar properties, and states that the former plant is called *Coquinha* by the Portuguese. In Malabar a decoction of the roots is used to relieve thirst in fevers and diabetes, and oil boiled on the roots to relieve pruritus of the skin. He also states that they distil an oil from the roots, which is of a dark yellowish-green colour, pleasant odour and

pungent taste, and which is used for the same purposes as the decoction and to promote the action of the liver.

Irving states that *K. monocephala* is used at Ajmere as an antidote like zedoary, and Roxburgh notices its use as an antidote in Bengal.

These plants have the odour, and apparently all the qualities, of *Cyperus rotundus*.

Description.—The roots are creeping, those of *K. triceps* bear tubers. The culms are erect and triangular, leafy at the base. The leaves membranaceous, flat towards the apex, ciliated with minute bristles on the margin and keel. The flower-heads of *K. monocephala* are solitary, globose, dense and white; whilst those of *K. triceps* consist of from 3 to 6 spikes, one of which is much larger than the rest. The involucres are 3 to 4 leaved, unequal, the longest leaf as long as the culm.

GRAMINEÆ.

ANDROPOGON SCHŒNANTHUS, *Linn.*

Fig.—*Royle, Ill., t.* 97; *Trin. Sp. Gr. iii., t.* 327. Russa grass, Ginger grass (*Eng.*), Schænanthe des Indes (*Fr.*).

Hab.—Indian Peninsula, Western Ghauts, extending sparingly to the coast. The essential oil.

Vernacular.—Sugandha rosá, Rusá, Gandhis, Gandhbel, Mirchiya gandh (*Hind.*, *Guz.*), Agiyá-ghás, Gandha-bena (*Beng.*), Sugandhirohisha, Rohishe-gavat (*Mar.*), Parimalada-ganjani (*Can.*), Sakanárú-pillú (*Tam.*).

History, Uses, &c.—This grass is the Bhustrina or Bhutrina "earth grass" of the Raja Nirghanta, and is also known as Rohisha in Sanskrit. Among the synonyms which it bears, we may mention Gandha-khéda and Gandha-trina "odorous grass," Su-rasa "well flavoured," and Su-gandha "having an agreeable odour." It is described as aromatic and stimulant and useful in bilious and phlegmatic affections.

Mahometan writers upon Indian Materia Medica confound *A. Schœnanthus* with Izkhir (*A. laniger*), and Mir Muhammad Husain gives *Rús* as an Indian name for Izkhir; he also mentions several other Indian names, such as Gandhis, Gandhbel, &c., showing that he was well acquainted with Rúsa grass. The author of the *Tuhfat-el-muminin* mentions a distilled water prepared from Izkhir, and also an oil made by macerating the grass in sweet oil exposed to the sun; it is therefore probable that in his time (1669) the essential oil was not made from *A. Schœnanthus*. The industry probably commenced in the 18th century whilst Khandesh was in a flourishing condition under its Mahometan rulers.

A. Schœnanthus was first brought to the notice of Europeans by General Martin, who collected the seeds in the Balaghat, during the war with Tippu Sultan, and cultivated the plant at Lucknow, whence he sent seeds to Roxburgh, in Calcutta. The first mention of the oil is by Maxwell in 1825 (*Calcutta Med. Phys. Trans.*, i., p. 367); it was afterwards described by Forsyth, 1827 (*Ibid.*, iii., p. 213). The *A. Nardus* of Ainslie, which he calls ginger or spice grass, is doubtless the same plant; he notices its use in infusion as a stomachic, and states that an essential oil is prepared from it which is useful in rheumatism.

Preparation of the oil.—The oil distillers in Khandesh call the grass *Motiya*, when the inflorescence is young and of a bluish-white colour; after it has ripened and become red, it is called *Sonfiya.** The oil obtained from it in the first condition has a more delicate odour than that obtained from the ripened grass. The Motiya oil is usually mixed with the second kind, which by itself would not fetch a good price in the European market. The grass grows freely, though not very widely, on open hill-sides in West Khandesh, especially in Akráni. The original seat of the manufacture was Pimpalner, but as the oil is in great demand, the manufacture has of late spread to Nandurbár, Sháháda, and Taloda. The makers are Musalmans, who, at the

* We are indebted to Mr. A. Lucas, Assistant Collector, Khandesh, for specimens of the Motiya and Sonfiya grasses from the distilling districts.

close of the rains, about September, when the grass is ripening, buy it from the Bhils, stack it, and set furnaces at the sides of brooks where wood and water are plentiful. A large pit, four feet long by two wide and two and a half deep, is dug, and a furnace (*chula*) prepared. On this furnace is placed a copper or iron caldron, large enough to hold from 30 to 50 pots of water. After pouring in some water, the caldron is filled to the brim with chopped grass, and a little more water is added. The mouth of the caldron is carefully closed with an iron or copper plate, made fast with wheat dough. From a hole in this lid, a bamboo tube, wrapped in a piece of cloth, plastered with the flour of *Udid* (*Phaseolus Mungo*, Linn., black var.), and bound with ropes, passes into a second closed caldron, sunk to the neck in running water. The steam from the grass is condensed in the second caldron, which, when full, begins to shake. The tube is then skilfully removed, and the contents of the caldron poured into a third similar vessel and stirred. Then the oil begins to appear on the surface, and is slowly skimmed off. The distillate is returned with fresh grass to the still. In 1879-80 the number of stills was 197, producing about 71 cwts. of oil. More than 100 stills are worked in Nandurbár alone, and the increase of the manufacture is prevented only by the scarcity of the grass. The oil is packed in skins, and sent on bullock back over the Kundaibári Pass to Surat, and by Dhulia and Manmad to Bombay.

We are assured by the Bombay dealers that all the oil of commerce is more or less adulterated; and a comparison of the commercial article with some oil distilled by one of us supports this statement; the adulteration is said to be practised by the distillers, who, we are informed, are regularly supplied with oil of turpentine from Bombay. 373 lbs. of grass received from Khandesh and submitted to distillation under our own superintendence in Bombay yielded 1 lb. 5½ ozs. of oil. Portions of this oil were mixed with oils of turpentine, groundnut, rape, and linseed; with all three it formed a milky or turbid mixture, but the two first, after standing for some days, became perfectly bright. We are informed that formerly it was the custom to

adulterate with groundnut oil, but that turpentine is now used, as it cannot be detected by the evaporation test.

The use to which Rúsa oil is put in Turkey, to which country it is principally exported, *viâ* Egypt and the Red Sea ports, from Bombay, was first explained by Hanbury (*N. Repert. f. Pharm.*, viii., 365), and in *Pharmacographia* we find the following interesting statement:—"No drug is more subject than attar of rose to adulteration, which is principally effected by the addition of the volatile oil of an Indian grass, *Andropogon Schœnanthus*, L. This oil, which is called in Turkish *Idris yaghi*,* and also *Entershah*, and is more or less known to Europeans as *Geranium oil*, is imported into Turkey for this express purpose, and even submitted to a sort of purification before being used.† It was formerly added to the attar only in Constantinople, but now the mixing takes place at the seat of the manufacture. It is said that in many places the roses are absolutely sprinkled with it before being placed in the still."

Description.—Root perennial, with long wiry fibres; culms erect, from 3 to 6 feet high, often ramous, smooth, filled with a spongy pith; leaves very long, tapering to a very fine point, smooth in every part, and of a soft delicate texture; sheaths, shorter than the joints on full-grown plants, with a membranaceous stipulary process at the mouth; panicles linear, subsecund; spikelets paired, but with only three joints; flowers also paired, one-awned, hermaphrodite and sessile, the other, awnless, male and pedicelled, the terminal florets are three, one hermaphrodite, sessile and awned, the other two male, pedicelled, and awnless.

Hermaphrodite calyx one-flowered, two-valved, base girt with wool, as is also the rachis and proper pedicels; corol one-valved,

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*عضرس, izris, pronounced *idris* by the Arabs, is a Persian word, and is explained in the *Burhán* as a kind of wild mallow which the Greeks call *Aluba* and the Arabs شحم المراج (shahm-el-maraj). If a decoction of it with vinegar and oil is rubbed on the limbs it protects against venomous bites. It is perhaps *Pavonia odorata* or some other odoriferous plant belonging to the Malvaceæ.

† For particulars, see Baur (p. 262, note 3).

a long black awn occupies the place of the other, which has two small filaments at its base; nectary two minute leaflets embracing the germ laterally; stamens, pistil, and seed as in the genus.

Male calyx as in the hermaphrodite; corol one-valved; nectary and stamens as in the hermaphrodite, no pistil. (*Roxburgh.*)

The oil of *A. Schœnanthus* distilled by one of us was dextrogyre, the ray being rotated 39° to the right by a column of 100 mm., and 78° by one of 200 mm. Some samples of the commercial oil rotated the ray about 13° to the right, and others had little or no effect upon it. The colour of the genuine oil was that of pale sherry; the commercial samples were more highly coloured. The odour at first resembles that of the rose, but there is a persistent and terebinthinate after-flavour which is not agreeable.

The taste is pungent and agreeable, approaching that of ginger.

Chemical composition.—The oil of this grass, which has been named *Geraniol* ($C^{10}H^{18}O$), is an alcohol belonging to the series $C^nH^{2n}—^2O$. The two samples examined by F. W. Semmler (*Ber. d. D. Chem. Ges.*, 23, 1098), which yielded 90 per cent. of geraniol, must have been adulterated, as they turned a ray of polarised light 20° to the left, whereas the genuine oil distilled by one of us was strongly dextrogyre. Geraniol, which occurs also in *Pelargonium Radula*, Aiton, has a fragrant odour of roses, and is miscible with alcohol and ether; the boiling point at 17 mm. pressure is 120°·5—122°·5, and the refraction 48·71. With calcium chloride at 50° it forms a crystalline compound ($C^{10}H^{18}O$) Ca Cl^2, decomposed by water and slowly oxidised by air. Potash-fusion forms isovaleric acid. Neutral aqueous $K^2M_nO^4$ forms acetic and isovaleric acids. Even boiling baryta-water slowly forms isovaleric acid. Chromic acid mixture forms citral (*Semmler*). HNO^3 forms nitrobenzene, HCy, oxalic acid, and a resin, but no camphoric acid. (*Beilstein Chemie*, iii., 265; *Watts' Dict. Chem.*, 2nd Ed., ii., p. 609; *Ber. v. Schimmel & Co.*, April 1891, p. 37.)

In medieval Europe it was officinal under the names of Schœnanthus, Squinanthus, and Juncus odoratus, and was also known as Fœnum vel stramen camelorum "camel's hay or straw," from its being the principle food of camels in the deserts between Syria and Egypt. In Arabia, under the name of *ghusúl*, the powdered grass is still used as a perfume for the bath.

Description.—This grass is distinguished by its simple rhizome, short thick tuft of radical leaves, and lanigerous calyx. The odour is like that of oil of Rhodium; the taste aromatic, bitter, and somewhat acrid.

Chemical composition.—From 56 lbs. of the dry grass purchased in the bazar we obtained the large yield of 8¾ ozs. of essential oil; it had a specific gravity of ·905 at 85° F., and rotated a ray of polarized light 8·0 degrees to the left in column 200 mm. long. The colour was that of pale sherry. According to Schimmel & Co., the essential oil reminds one of the odour of Elemi oil. Its sp. gr. is ·915, the optical rotation +34° 38′. It boils between 170° and 250°, and contains phellandrene (*Bericht von Schimmel & Co.*, April, 1892).

ANDROPOGON CITRATUS, *DC.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 280; *Rheede, Hort. Mal. xii., t.* 72. Lemon grass (*Eng.*), Chiendent-citron (*Fr.*).

Hab.—Eastern Archipelago? Cultivated throughout India. The herb and oil.

Vernacular.—Ágya-ghás, Agin-ghás (*Hind.*), Gandha-bena (*Beng.*), Hirva-chaha, Olen-chaha (*Mar.*), Lili-chahe, Nili-chahe (*Guz.*), Váshana-pulla (*Tam.*), Nimma-gaddi, Chippa-gaddi (*Tel.*), Vásana-pulla, Sambhára-pulla (*Mal.*), Purváli-hullu Vásane-hullu (*Can.*), Pengrima (*Cing.*).

History, Uses, &c.—This grass is not mentioned to our knowledge by any of the Hindu or Mahometan writers upon Indian medicinal plants. It was observed by Van Rheede early in the 17th century as an established and well-known cultivated plant, and it is not improbable that Hindu colonists

returning from Java may have introduced it. The Hindus colonized that island in the 5th century, and in the 7th century there was much intercourse between the mother-country and the colony. In Java the grass is called Sireh; it was known to Rumphius and other early writers on the natural history of the East, and in 1717 an oil distilled from it in Amboyna was known as a curiosity. (*Ephem. Nat. Curios.*, cent. v—vi., Appendix 157, quoted in *Pharmacographia.*) Lemon-grass oil is mentioned by Roxburgh in 1820 as being distilled in the Moluccas, and it was first imported into London about the year 1832. An infusion of the fresh herb is a favorite native remedy in India as a diaphoretic and stimulant in catarrh and febrile conditions, and also in the congestive and neuralgic forms of dysmenorrhœa. The oil is used as a carminative and as an application in chronic rheumatism. The oil has been made official in the *Pharmacopœia of India.* Dr. Waring, in the appendix to this work, records a high testimony in its favour both as an external application in rheumatism and in other painful affections, and as a stimulant and diaphoretic internally. He states that amongst the half-castes of South India it is one of their most highly esteemed remedies in cholera. In infusion the leaves are often combined with tea, mint, or black pepper. The oil is distilled in rude stills at the Western base of the hills in Travancore, from Anjengo northwards. The grass is burnt at the end of the dry weather. In Europe the oil is now a well-known article of commerce under the names of Lemon-grass oil, Oil of Verbena, and Indian Melissa oil. It is employed as an ingredient in perfumes, such as Eau de Cologne, and for scenting soaps, and also for adulterating the "true Verbena oil" obtained from *Lippia citriodora* in Spain.

Description.—Root perennial, young propagating-shoots issue from the axils of the leaves that surround a short, subligneous leaf-bearing culm. Culms from 5 to 7 feet high, erect, simple, smooth, about as thick as a goose-quill. Leaves many, near the root bifarious, few on the upper part of the culm, of a soft texture, pale-green colour, slightly scabrous on

the margins, otherwise smooth; from 3 to 4 feet long, including their sheaths, and about ¾ of an inch broad. Floral leaves small. Panicle linear, a little bent to one side, composed of many fascicles of spikes that are both terminal and form the exterior axils. Spikes generally paired on a common peduncle, with a common boat-like spathe, or involucre at the division; each has also its proper pedicel, and both spathe-shaped. Rachis articulated, much waved, hairy. Flowers in pairs, one hermaphrodite and sessile, the other male and pedicelled; the last hermaphrodite flower of each spike has two males; below there is only one male, as the rachis occupies the space of the other. Hermaphrodite flowers sessile. Glume girt at the base with wool. Corol 2-valved, awnless. Nectary, two, broad, short, wedge-formed, obliquely lobed, crenulated bodies embrace the insertion of the filaments and the forepart of the germ. Male flowers pedicelled, calyx, glumes as in the hermaphrodite ones. Corol 1-valved, awnless. Nectary as in the hermaphrodite, stamens three. This grass flowers in the rains, but rarely.

Chemical composition.—The most interesting constituent of this oil is *Citral*, which has been examined by J. W. Semmler (*Ber. d. Deutsch. Chem. Ges.*, 23, 3556, and 24, 203). This author found that the aldehyde $C^{10}H^{16}O$, obtained by the oxidation of geraniol with chromic acid mixture, is identical with the citral of oil of lemons. By further oxidation with argentic oxide he prepared *Geranic acid*, $C^{10}H^{16}O^{2}$, a limpid oil, and by treating citral with acid sulphate of potassium, *Cymol* was formed, a molecule of water splitting off.

Up to the present time citral has been found by Messrs. Schimmel & Co. in the following essential oils:—

Lemon oil	from	*Citrus Limonum.*
Limetta oil	,,	*Citrus Limetta.*
Mandarine oil	,,	*Citrus Madurensis.*
Lemon grass oil	,,	*Andropogon citratus.*
Eucalyptus oil	,,	*Eucalyptus Staigeriana.*
Backhousia oil	,,	*Backhousia citriodora.*
Citronella fruit oil	,,	*Tetranthera citrata.*
Japan pepper oil	,,	*Zanthoxylon piperitum.*

Commerce.—The oil is largely exported from Singapore and Ceylon, where the grass is cultivated. The shipments from the Malabar Coast during the last four years were as follows:—1887, 943 cases; 1888, 1,678 cases; 1889, 979 cases; 1890, 1,610 cases. The exports from Cochin have risen from 228 cases in 1884 to 2,387 cases in 1889 and 1,917 cases in 1890. A case contains 12 bottles of oil, and is priced at Rs. 18¼. A bottle is guaranteed to hold 23 ounces of oil.

ANDROPOGON NARDUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 297. Citronelle grass (*Eng.*).

Hab.—Ceylon, Travancore, cultivated at Singapore. The essential oil.

Vernacular.—Maana (*Cing.*).

History, Uses, &c.—This grass is considered by some botanists to be the wild form of *A. citratus*. Other grasses closely allied to it are *A. Khasianus*, Munro, growing in Silhet, and *A. distans*, Nees, growing in the North-West Provinces and in parts of the Bombay Presidency, but no oil has ever been distilled from these species, nor do they appear to be used medicinally by the natives.

A. Nardus is not mentioned in any Sanskrit medical work, nor do the Arabian and Persian medical writers notice it. It owes the name *Nardus* to its having been confounded with *A. laniger*, which was named νάρδος by the Greeks who invaded India. At the present time it is only known in Southern India and Ceylon, and the Hindi names which have been ascribed to it in the *Dict. Econ. Prod. of India* properly belong to *A. Schœnanthus* or *A. citratus*.

Description.—A large perennial herb, with a long slightly branched, partly aërial rhizome, reaching ½ inch in diameter, and strongly ringed with the closely-placed scars of the leaf-sheaths, the remains of which persist on the upper portion, and giving off numerous tough root fibres. Stem reaching 6 feet or more high, erect, stout, cylindrical, solid, smooth and shining, partially concealed by the leaf-sheaths,

scarcely thickened at the nodes, which are approximated below, but widely separated above, flat or channelled on one side in the upper portion. Leaves very large and long, numerous, erect, lower ones sometimes reduced to their sheaths; sheaths thick and strong, about 6 inches long, closely but not entirely enveloping the stem, quite smooth, striate; ligule short, brown, laciniate, scarious; blade about 2 feet long, linear, very much attenuated at the apex, tapering below, minutely denticulate with forward points on the edges, smooth on both surfaces, pale somewhat glaucous green, lighter beneath. Spikelets very small, arranged in couples, one-stalked, containing one male flower, the other sessile, with one hermaphrodite and often one barren flower; the couples, to the number of 3 or 4, articulated on alternate sides of a short, flattened, jointed rachis clothed along the edges with long white silky hairs tufted beneath the spikelets, forming a short acute spike about $\frac{1}{2}$—$\frac{3}{4}$ inch long; the spikes arranged in pairs on a common slender stalk, at the bent basal node of which is a large, erect, acute, leafy, striate, orange-red, shining bract, scarious at the edges, which encloses the pairs of spikes before expansion; the pairs of spikes very numerous, placed on the somewhat zic-zac, elongated, smooth, slender, erect, flattened branches of elongated panicles, which come off in clusters from the axils of the upper leaves, the whole forming a very large tufted, elongated somewhat drooping inflorescence, often 2 feet or more in length; glumes nearly equal, acuminate, membranous, smooth, purplish, boat-shaped, the lower one of the sessile spikelet flattened on the back against the rachis and without a mid-rib, those of the stalked spikelets with several parallel strong veins; pales of the lower spikelet 2, or with a third representing a barren flower, very unequal, the lower very small, deeply bifid with two long cusps, from between which comes off a long, slender, slightly kneed purple awn, about twice the length of the glumes, and projecting considerably beyond the spikelet, the upper much larger, acute but without an awn, very delicate and membranous, without veins; in the flower of the upper spikelet there is but a single membranous non-awned

pale. Lodicules 2, oblong, truncate, longer than the ovary. Stamens 3, anthers purple. Stigmas 2, spreading, protruded from the flower, plumose, bright red-purple. Fruit not united with the pales. (*Bentley and Trimen.*) The oil is of a pale yellow colour when pure. Mr. J. C. Umney (*Pharm. Journ.*, Ap. 11, 1891, p. 922) has shown that the green colour of the commercial oil is due to the presence of copper. According to Messrs. Schimmel, the sp. gr. should not fall below ·895 at 15°C. The oil is often adulterated with petroleum.

Chemical composition.—E. Kremers (*Proc. Am. Pharm. Assoc.*, 1887, p. 562) found the oil to consist of an aldehyde ($C^7H^{14}O$), a terpene ($C^{10}H^{16}$), an isomer of borneol, named Citronellol, and acetic and valeric acids. These two acids are said to be formed through the oxidation of the aldehyde and to exist originally in combination with citronellol as a compound ether. T. D. Dodge (*Am. Chem. Journ.*, 1889, p. 456) obtained somewhat different results. The aldehyde, isolated from the oil by means of a concentrated solution of sodium bisulphite, according to Kremers is $C^7H^{14}O$, while Dodge obtained results corresponding to $C^{10}H^{18}O$, and names the compound *citronellic aldehyde.* By the action of P^2O^5, an oily product, probably a terpene, was obtained. By heating the dibromide of the aldehyde the distillate contained a small quantity of oil having the odour of cymene, $C^{10}H^{14}$, thus confirming the statement of C. R. A. Wright (*Journ. Chem. Soc.*, 1875, p. 1). Oxidation with potassium permanganate yielded a mixture of fatty acids smelling strongly of valeric acid. A portion of the oil boiling at 77° C. was probably a terpene. The portion boiling at 222° C., probably *citronellyl alcohol,* $C^{10}H^{20}O$, the same as obtained by the reduction of citronellic aldehyde, the acetyl derivatives of both having the same characteristic rose-like odour.

ANDROPOGON ODORATUS, *Lisboa.*

Fig.—*Journ. Bombay Nat. Hist. Soc. iv.*, p. 188.

Hab.—Western Ghauts, extending sparingly to the coast. The grass.

Vernacular.—Vaidi-gavat, Usadhana (*Mar.*).

History, Uses, &c.—This grass is not, to our knowledge, mentioned by Sanskrit writers, but is well known to the peasantry by the names given above, which signify "physician's grass" and "pungent grass." *A. odoratus* was first observed by one of us in 1875 as a grass growing sparingly at Tanna, near Bombay, and used by the natives as a carminative in the bowel complaints of children (*Mat. Med. of Western India*, 1st Ed., p. 693). In 1889 this grass was found growing abundantly at Lanowli on the Western Ghauts by Mrs. J. C. Lisboa, and was described and figured in the *Journal of the Bombay Natural History Society.* We have since distilled the grass and obtained from it an essential oil having at first an odour recalling that of cassia and rosemary, but afterwards a strong persistent odour of oil of cassia. Messrs. Schimmel & Co. notice the odour of Pine needle oil in this sample, and find the sp. gr. to be ·945.

Description.—Root as in *A. Schœnanthus.* Culm erect, 3—5 ft. high, sometimes branching from the lower part, glabrous; nodes long-bearded. Leaves lanceolate, cordate at the base, acute or acuminate, with a few long hairs; the lower cauline and radicle leaves long, the upper small, but their sheaths very long. Ligula small. Spikes numerous, erect, branched, pedicellate (the pedicel of the lower spikes longer), and congested at the end of a long peduncle without a sheathing bract and forming an erect, dense, ovoid panicle. The rachis, pedicel, and the spikes covered with long silky hairs. Spikelets nearly two lines long, of a purple colour, the sessile and the pedicellate nearly similar; outer glume of the sessile spikelet rather thin, many-nerved, somewhat obtuse and covered with long silky hairs, with a pit in some spikelets of the same plant and absent in others; second glume as long as the first or a little longer, but broader, thin, and keeled; third glume thinner and hyaline; fourth glume, smaller or an awn ½—1 inch long, with a hermaphrodite flower at the end of the pedicel. Pedicel of the pedicellate spikelet covered with white hairs, but the spikelet almost free of hairs. Outer glume stiff, with five or more nerves, not prominent, almost

obtuse; second glume thinner, with three nerves, somewhat broader, but as long as the first; third glume hyaline, smaller; fourth glume very small, hyaline or none; no awn; at the top of the pedicel three stamens not well formed and not as large as in the hermaphrodite flower. (*J. C. Lisboa.*)

The yield of oil from the grass was equal to that obtained from *A. Schœnanthus*; it had a deep sherry colour, a specific gravity of ·931 compared to an equal volume of water at 84° F., and a rotatory power of —22·75 in a column of 100 mm. or $(\alpha)^D = -24{\cdot}43$.

ANDROPOGON MURICATUS, *Retz.*

Fig.—*Beauv. Agr., t.* 22. Cuscus (*Eng.*), Vettivér (*Tam.*), Chiendent des Indes (*Fr.*).

Hab.—Coromandel, Mysore, Bengal, Northern India. The roots.

Vernacular.—Khas, Bála, Panni (*Hind.*), Khaskhas, Bená (*Beng.*), Vála, Várélu (*Mar.*), Válo, Khaskhas (*Guz.*), Vettivér (*Tam.*), Vattivéru (*Tel.*), Báladvéru (*Can.*).

History, Uses, &c.—The root of this grass, which is the only part of the plant having aromatic properties, is described in the Nighantás under the name of Usíra, and bears among other synonyms those of Virana, Véni-mulaka "having braided roots," Sugandhi-mulaka "having sweet-smelling roots," Sita-mulaka "having cool roots," &c. It is considered to be cooling, refrigerant and stomachic, removing bile and phlegm, and useful to allay thirst in fever and inflammatory affections. An infusion is used, and it enters into the composition of several cooling mixtures. Sir W. Jones suggests that it is the *Mrinála* mentioned in Kalidasa's *Sakuntala*, but that name is more commonly applied to the leaf-stalk of the Lotus than to the roots of this grass. All parts of the Lotus are renowned for their cooling properties, and the use of the Water Lily for Sakuntala's complaint appears to us to be more poetical. In Vedic times the ancient Hindus were instructed

to build their houses in a place where the Virana and Kusa were abundant, and on some copper-plate inscriptions discovered near Etawah, dated A.D. 1103 and 1174, this plant is mentioned as one of the articles upon which the kings of Kanauj levied imports (*Proc. As. Soc. Bengal*, 1873, p. 161). Externally it is used in a variety of ways: a paste of the root is rubbed on the skin to relieve oppressive heat or burning of the body; an aromatic cooling bath is prepared by adding to a tub of water the root in fine powder, together with the root of *Pavonia odorata*, red sandalwood and the wood of *Prunus Puddum*. The same ingredients are applied in the form of a thin paste to the skin. (*Chakradatta.*)

All over India the roots are made into aromatic scented mats, hung in door-ways, and kept wet to cool and perfume the atmosphere during the hot season; they are also much used for making fans, ornamental baskets, and other small articles. When distilled with water, the roots yield a fragrant oil, which is used as a perfume and for flavouring sherbet. Mir Muhammad Husain, in the *Makhzan-el-Adwiya*, describes *khas* as a kind of Izkhir used in India, known as Izkhir-i-Jámi and called by the Persians Bikh-i-wála. European physicians in India have used the root as a diaphoretic, and Pereira (*Mat. Med.*, ii., Pt. I., p. 132) states that in 1831 it was used in Paris and Hamburg as a preservative against cholera, being hung up in rooms and burnt as a fumigatory. In 1837 it was recommended by Foy in rheumatism and gout. At the present time the root is distilled in Europe to obtain the oil. which commands a high price, being used in the composition of many favourite perfumes, as "Mousseline des Indes," "Maréchal," "Bouquet du Roi," &c.

Description.—*A. muricatus* has an erect compressed culm, 5 to 6 feet high, with smooth nodes and linear-narrow sub-bifarious rigid elongated leaves; the panicle is verticelled; the branches are very numerous, simple and spreading; the joints of the rachis are smooth; the glumes are minutely prickly on both sides, sub-equal, muricated. The radicles are

very numerous and spring from a rhizome, on the upper surface of which are leaf-buds. The entire root is of a yellowish-brown colour, and has a strong and persistent odour, somewhat like myrrh ; the taste is bitter and aromatic.

Chemical composition.—Khaskas has been analysed by Vauquelin, who has obtained from it a resinous substance of a deep red-brown colour, having an acrid taste and an odour like myrrh ; a colouring matter soluble in water ; a free acid ; a salt of lime ; a considerable quantity of oxide of iron ; a large quantity of woody matter. (*Annales de Chimie*, lxxii., p. 302.)

The oil is difficult to extract; this difficulty may be overcome by placing the roots in a steam-jacketted still with just sufficient water to drench them, allowing to stand for a short time, and then admitting steam at about 15 lbs. pressure into the jacket, when a light oil will come over. A current of steam afterwards admitted into the still and raised to 25 lbs. pressure will bring over the heavier portion of the oil. Piesse states the yield to be 10 ozs. per cwt.

COIX LACRYMA, *Linn.*

Fig.—*Bot. Mag., t.* 79; *Rheede, Hort. Mal. xii., t.* 70. Job's tears (*Eng.*), Larmes de Job (*Fr.*).

Hab.—Plains of India and warm hill-slopes from the Punjab to Burma. Cultivated on the hills. The seeds.

Vernacular.—Sankhru, Sankhlu, Gargari-dhàn (*Hind.*), Gargar, Kunch (*Beng.*), Rán-jondhala, Rán-makai (*Mar.*), Kasái (*Guz.*).

History, Uses, &c.—The different species of Coix bear the Sanskrit names of Gavídhuka, Gavedhu, and Gavedhuka. They are mentioned in Vedic literature, and appear to have been one of the cereals which were cultivated by the Arians on the hill-slopes of the Himalayas. They are still cultivated by the hill-tribes in the Khasia and Naga Hills and in Assam and Burma, where they are known by the vernacular names of Kasi, Kulésé, Kalinsi, Kyeit, &c., and are

used as a food-stuff. The wild form, common in the plains, is only used for medicinal purposes, and is considered to be strengthening and diuretic. The Arab travellers in the East became acquainted with the seeds and named them Damu Dáud "David's tears," and afterwards Damu Ayúb "Job's tears." Es-Sághâni, who died about the year 1260, mentions them in the *Obâb* as a well-known strengthening and diuretic medicine. The Arabs introduced the plant into the West, and it has become naturalized in Spain and Portugal, where it is still known as *Lagrima de Job.* European botanists have rather inappropriately given the name of Coix (Greek κοιξ) to this genus, Coix being the name of a kind of palm growing in Africa and mentioned by Theophrastus and Pliny.

The following notice of *C. lacryma* occurs in the *Descriptive Catalogue of the Vienna Exhibition*, 1873 :—"The seeds known as Job's tears are used as food in China and Malacca, under the name of Eejin or Ee-yin. 'It is,' we are told, 'the most remarkable among food-grains for its chemical composition.' Dr. Smith writes that 'it is larger and coarser than pearl-barley, but it is equally good for making gruel. As it is sold for five pence per Chinese pound, it makes an excellent diet-drink for hospital patients in China.' Dr. Hooker observes that 'a great deal of Coix is cultivated in the Khasia Hills; the shell of the cultivated sort is soft and the kernel is sweet, whereas the wild Coix is so hard that it cannot be broken by the teeth; each plant branches two or three times from the base, and from seven to nine plants grow in each square yard of soil; the produce is small, not above 30 or 40 fold.' In Mason's '*Burmah*' it is stated that a species of Coix, with large esculent seeds, which are parched like Indian corn, are often for sale in the bazars, and are cultivated very extensively by the Red Karens."

C. lacryma has also been introduced into Brazil, where it is cultivated to some extent. For much interesting information concerning the different species or varieties of the plant, and the economic uses to which the seeds are put, we must refer the reader to the *Dict. Econ. Prod. of India*, ii., p. 492.

Description.—The silicious involucre of this grass containing the seed is sold in the drug shops. It is about the size and has much the appearance of a small cowrie shell, shining white, and very hard. At the base is a scar marking the attachment of the peduncle; at the apex an opening, from which, even in the dry state, a portion of the female flower may be seen protruding. In the fresh state a spike of male flowers, from one to two inches long, rises from it.

Chemical composition.—Church (*Food Grains of India*) found the edible grain, separated from the husk, to contain water 13·2, albuminoids 18·7, starch 58·3, oil 5·2, fibre 1·5, ash 2·1 in 100 parts. Peckholt, who examined the seeds grown in Brazil, ascertained that 1000 parts afforded (among less important constituents) fatty oil 6·6, resin 3, sugar 7, starch 84, husks and shell 696 parts. (*Cat. of the Exhibition of* 1866 at *Rio de Janeiro.*)

ERAGROSTIS CYNOSUROIDES, *Rom. et Sch.*

Fig.—*Delile, Descr. de l'Egypte, t.* 10; *Rheede, Hort. Mal. xii., t.* 57.

Hab.—Throughout the plains of India. The herb.

Vernacular.—Kusa, Darbha (*Hind.*), Kusha (*Beng.*), Darbha, Kusha (*Mar.*).

History, Uses, &c.—In Hindu ritual the Kusa occupies much the same position as the Durva and Tulasi. Among the synonyms for this grass are Darbha, Barhis "that which is plucked up," Suchy-agra "needle-pointed," Yajna-bhushana "ornament of sacrifice," Dirghapattra "having long leaves," Vajna "lightning," Suchi-mukha "needle-mouthed," Punya-trina "holy grass," &c. Its pointed leaves are used for the purification of sacred beverages, and spread beneath the sacrificer and the sacrifice, like the Vervein was amongst the Romans. In the Vedas this plant is often invoked as a god: "Thee, O Darbha, the learned proclaim a divinity not subject to age or death; thee they call the armour of Indra, the preserver of regions, the destroyer of enemies; a gem that gives

increase to the field; at the time when the ocean resounded, when the clouds murmured, and lightning flashed, then was Darbha produced, pure as a drop of fine gold" (*Atharva Veda*). The Vedic rituals furnished instructions for its use. According to Ásvalayána, two pieces without knots were used for purifying butter—one was to be held in each hand between the thumb and the fourth finger, the second and third fingers being raised. Turning towards the East, Savitri, Vasu, and the Sun's rays were invoked. At the new and full moon they fasted and tied together Kusa and firewood, hence the name Kusákara for fire, the sacred fire being made upon a tuft of the grass. At the time of the first cutting of a child's hair, the father took a position to the south of the mother, and, holding in his hand twenty-one blades of the grass (to represent the twenty-one Maruts or winds), invoked Vayu, the god of wind. The father, or, in his absence, a Brahmin, then took three blades of the grass and thrust them, points foremost, into the child's hair, saying, "O herb protect him." The Vedic homestead was directed to be built in a place where the Kusa and Virana grew, its foundations were to be strewed with the grass, and all prickly herbs, as the *Apamarga*, the *Saka*, the *Tilvaka*, and the *Parivyádha*, were to be extirpated. When they learned the sacred books, students used to sit upon a spot of ground strewed with the Kusa, and on leaving they carried away, amongst other things, some blades of the grass as a remembrance and good omen. In the Brahmanic period the Kusa was used in invoking Vishnu; anchorites covered their nakedness with the grass, or with the skins of animals and bark of certain trees. In modern times it is in constant requisition in Hindu ceremonial, and at funerals the chief mourner wears a ring of the grass upon his finger, and it is placed beneath the *pîndas*. Brahmins place it in the hands of pilgrims when they bathe in the sacred Ganges. M. Sénart draws a comparison between the Vedic *Kusa* and the Beresman of the ancient Persians, and explains its significance in Buddhic ritual: it serves as a sacred prayer-carpet which is presided over by the divine Intelligence. As a medicine it enters into

compound prescriptions for dysentery and menorrhagia, and is specially used as a diuretic. It is often confounded with *Cynodon dactylon* by the herbalists, or perhaps they consider both grasses to be equally efficient.

Description.—Root creeping, perennial. Culms straight, rigid, round, smooth, from 1 to 3 feet high. Leaves numerous, very long, chiefly about the base of the culms, rigid margins hispid. Panicle erect, linear-oblong, often tending to a conical form, composed of many somewhat threefold, verticelled, horizontal, short, rigid, secund ramifications. Spikelets many-flowered, depending, in two rows, from the under-side of the ramifications. Valves of corolla pointed, the inner one rather the largest.

CYNODON DACTYLON, *Pers.*

Fig.—*Eng. Bot. xii., t.* 850; *Fl. Græc., i., t.* 60. Creeping Dog's-tooth-grass (*Eng.*).

Hab.—Plains of India, westward to the south of England. The herb.

Vernacular.—Durvá, Dúb, Hariyáli (*Hind.*), Durba (*Beng.*), Durvá, Harala, Haryáli (*Mar.*).

History, Uses, &c.—This grass must have first attracted the attention of the ancient Hindus by its value as a food for their cattle. A modern Indian proverb says—Zamindári dúb ki jár hai (an estate like the roots of the Dúb, *i.e.*, is always bearing). The plant has many synonyms in Sanskrit, such as Granthi "knotted," Sveta "white," Bhárgavi "belonging to Sukra" (the regent of the planet Venus), Ruha "growing," Dur-mara "not easily dying," &c. Nanak Shah thus apostrophizes himself:—

> Nanak! nannhá ho raho jaisi nannhi dúb!
> Aur ghás jal jáengi, dúb khúb ki khúb.
>
> Be modest Nanak! as the fresh soft *Dúb* doth lowly lie,
> Whilst other grasses scorched up are, the *Dúb's* bloom ne'er doth die. (*Fallon.*)

In the *Rig-Veda* (x., 134) misfortunes are prayed to depart like the Dúrva whose seeds fall far from the plant; an allusion to the far-spreading habit of this grass, which has also given

rise to the proverbial expression "Dúb ki nal" (the sheath of the Dúb) as applied to family connections, so called from their tendency to spread far and wide like the Dúb. Like other useful plants this grass was deified by the Hindus; in the *Atharva-Veda* it is thus addressed— "May Dúrva which rose from the water of life, which has a hundred roots and a hundred stems, efface a hundred of my sins, and prolong my existence on earth a hundred years." The Hindus believe that a benevolent Apsaras or nymph dwells in the plant, and when they build a house they place the grass on the four corners of the foundations. This practice dates from Vedic times.

Dúrva is also spoken of as Dúrveshtaka, from its being used in erecting an altar; it is sacred to Vishnu and Ganesha, and a festival called the Dúrváshtami is held in its honour on the eighth day of the light half of the month Bhadra; at this festival the male worshippers wear the grass tied to the right arm, and the females tied to the left. At marriages the right arm of the bridegroom is tied to the left arm of the bride with Dúrva; it is a phallic emblem, like the *fétu* or straw was in Europe. In the third act of the *Vikramorvasi* of Kálidasa, Urvasi shows herself to Purúravas with her hair decked with Dúrva, a symbol that she accepts his love. De Gubernatis says:—"A Pésaro, le jeune paysan, lorsqu'il désire demander en mariage la jeune fille qu'il aime, ôte du pailler un fétu de paille et, en le lui montrant, lui demande si elle veut entrer dans sa maison." According to Ásvaláyana and Náráyana, the husband, in the third month of his young wife's pregnancy, should squeeze the juice of the Dúrva into her right nostril to secure a male child; this practice is still customary in Western India and probably elsewhere. Dúrva is one of the eight ingredients of the *Arghya*, a respectful oblation made to gods and venerable men. The popular version of the *Ramayan* mentions the eight ingredients in the following couplet:—

Dahi, Dúrba, rochan, phal múlá
Nav tulsi dal, mangal múlá,

i.e., curdled milk, dúrba, rochan, flowers and roots, young leaves of the Tulsí and Lotus, turmeric.

According to the *Panchatantra*, Dúrva was born from the hairs of a cow; in a strophe quoted by Böhtlingk (*Ind. Spr.*, ii., 2921), the leaf is described as the ornament of the Dúrva, like the flower of the tree, independence the ornament of man, and the husband the ornament of the wife; happy are the gazelles who eat the Dúrva, for they see not the face of rich fools. Dúrva is mentioned in the Nighantás; medicinally the fresh juice is considered astringent, and is used as a snuff in epistaxis. The bruised grass is a popular application to bleeding wounds. The Indo-Portuguese call it *gramina*, and use it as a substitute for *Triticum repens*, L., which is generally considered to have been the ἄγρωστις of the Greeks, and Gramen of the Romans, though some authorities are of opinion that both *T. repens* and *Cynodon dactylon* were used indiscriminately by the ancients.

Description.—The roots are tough and creeping, almost woody, with smooth fibres. Stems also creeping to a great extent, matted, round, jointed, leafy, very smooth. Leaves tapering, sharp-pointed, ribbed, hairy, a little glaucous; with long striated smooth sheaths, and a hairy stipula. Flowering branches a span high, leafy, simple, terminating in 4 or 5 nearly equal, crowded, erect, many-flowered linear spikes; the common stalk of each triangular, roughish; flat and slightly bordered on one side, along which the nearly sessile, shining, purplish flowers are ranged in two close alternate rows. The corolla is longer than the calyx, very much compressed, opposite with respect to the latter.

ZEA MAYS, *Linn.*

Fig.—*Lam., Ill., t.* 749; *Bentl. and Trim., t.* 296. Maize, Indian Corn (*Eng.*), Maïs, Blé turc (*Fr.*).

Hab.—S. America and West Indian Islands. The stigmas and meal.

Vernacular.—Makkái, Bhuta (*Hind., Guz.*), Janar (*Beng.*), Makkái, Bonḍa (*Mar.*), Makka-sholom (*Tam.*).

History, Uses, &c.—A wild form of this cereal is said to be still found in some of the West Indian Islands. The vernacular names point to its introduction into India from Mecca, but the Durah-i-Makka or Gandum-i-Makka of Mahometan writers on Materia Medica, which they also call Khanderús (χόνδρος), is the *Sorghum vulgare* or Great millet, the *Juar* of Northern India, and the *Sholam* of Madras. The Arabs call *Zea Mays* Durah kízán or Durah shámí. We learn from Chinese literature that it was cultivated in China in the 16th century, and was then traditionally asserted to have been an introduction from the west. On the Continent of Europe, it is best known as Turkish corn. It is now cultivated in all warm countries, and is considered by Mahometan physicians to have properties similar to those of *Sorghum vulgare*, *viz.*, resolvent, astringent, and very nourishing; they consider it to be a suitable diet in consumption and a relaxed condition of the bowels. In Europe it is much used as a valuable article of diet for invalids and children under the names of *Polenta* (Maize meal) and *Maizena* (Maize flour). In Greece the silky stigmata are used in decoction in diseases of the bladder, and have lately attracted attention in America under the name of *Corn silk*, of which a liquid extract is sold in the shops as a remedy in irritable conditions of the bladder with turbid and irritating urine; it has a marked diuretic action. The meal has been long in use in America as a poultice, and gruel is also made of it. In the Concan an alkaline solution is prepared from the burnt cobs and is given in lithiasis.

In the United States for starch manufacture from maize it has been found desirable to get rid of the oily embryo—this is done by machinery. The embryo is too rich for feeding stock unless the oil is removed—this is done in the hydraulic press, and the cake when ground into meal is very valuable as a food for stock. The oil promises to be useful for medicinal purposes instead of olive oil. In the unrefined state it has a specific gravity of ·916 at 15°C., the elaidin test shows the presence of a large quantity of olein. Maize oil is of a pale

yellowish-brown colour, with an odour and taste like that of freshly ground corn meal; it belongs to the non-drying group of the vegatable oils, does not easily become rancid, and has no purgative action. With alkalies it forms a white soap; it contains fatty acids (free) 0·88, total fatty acids 96·75 per cent., mucilaginous bodies 1·34. The loss sustained by purification is under 5 per cent. (*J. U. Lloyd, Amer. Journ. Pharm.,* July 1888.)

Chemical composition.—The average results of the analysis of three varieties of maize in an undried state by Polson, yielded in 100 parts, 54·37 starch, 8·83 nitrogenous substance, 4·50 fat, 2·70 gum and sugar, 15·77 cellulose, 12·16 water, and 1·67 ash. Poggiale found on an average in 160 parts of the dried grain, 64·5 starch, 6·7 fat, and 9·9 nitrogenous substance. Church found it to contain water 12·5, albuminoids 9·5, starch 70·7, oil 3·6, fibre 2·0, ash 1·7. American grain contained 1 per cent. more fat than Indian.

The following figures, quoted by König, represent the mean composition of 145 samples examined by various analysts:—

	Minimum.	Maximum.	Mean.
Water	7·40	22·40	13·12
Albuminoids	5·54	13·90	9·85
Fat	1·61	8·89	4·62
Nitrogen-free extractive	60·49	74·92	68·41
Cellulose	·76	8·52	2·49
Ash	·61	3·93	1·51

The stigmata have been examined by C. J. Rademaker and J. L. Fischer (*Amer. Journ. Pharm.*, 1886), with the following results:—

Fixed oil (petroleum spirit extract)	5·25
Resin, crystalline principle, and chlorophyll (ether extract)	2·25
Resin, crystalline principle, and chlorophyll (alcoholic extract)	3·25
Sugar, gum, and extractive (water extract) ...	19·50
Albuminoids, phlobaphene, &c. (from alkaline solution)	3·50
Salts and extractive (from acid solution)	5·50
Cellulose	37·00
Water	20·00
	96·25

LOLIUM TEMULENTUM, *Linn.*

Fig.—*Engl. Bot. xvi., t.* 1124; *Schreb. Gram. ii., t.* 36; *Bentl. and Trim.* 295. Bearded Darnel (*Eng.*), Ivraie (*Fr.*).

Hab.—A weed of cultivation. Asia, Europe, North Africa. The seeds.

Vernacular.—Múchhni (*Hind.*).

History, Uses, &c.—A noxious weed growing with wheat called αἶρα is mentioned by Theophrastus (i., 5), and by Dioscorides (ii., 91); the latter writer notices its medicinal use as an external application along with salt and radishes to ulcers, and with sulphur and vinegar to certain skin eruptions, also with pigeon's dung and linseed to disperse or mature glandular and gouty swellings. It was also used with bitumen, myrrh, saffron or frankincense as a fumigatory to promote conception. This plant was known to the Romans as Lolium, and is mentioned by Virgil (Georg. I) as "*infelix lolium.*" Ovid (Fast, i.) speaks of it as injurious to the eyesight, "et careant loliis oculos vitiantibus agri." Pliny

mentions it in his chapter upon the diseases of grain (18, 44), and again (22, 58, 77) reproduces the account given by Dioscorides of its medicinal uses. The Arabian lexicographers describe the same plant under the name of Zúwán or Ziwán (زوان) as a noxious weed growing among wheat, which often gives a bad quality to it when accidentally mixed with it, causing giddiness; they consider it to be the same as the plant called Shailam (شيلم). Abu Hanifeh says, that Shailam is a small, oblong, red, erect grain, resembling in form the سوس (or grub) of wheat; and it does not intoxicate, but renders the wheat very bitter; and in one place he says the plant spreads on the ground, and its leaves are like those of the willow.

Ibn Sina describes Zúwán and Shailam separately, but in his account of their properties there is hardly any difference, it being essentially the same as Dioscorides' description of Aira. He states, however, that both are narcotic.

Forskal considers Zúwán and Shailam to be different. Of the former he says:—"Zizania Allepensibus notissima: inter triticum viget: si semina restant farinæ (sic) mixta, hominem reddunt ex panis esu temulentum: messores plantam non separant; sed post triturationem vanni aut cribri ope semina rejiciunt." Of the latter he says:—"Shalim etiam agri vitium; a priore (ziwan) tamen diversa species; decocto plantæ obtunduntur sensus hominis qui operationem chirurgicam subire debet; Avicenna sic referente." (*Fl. Ægypt Arab.*, p. 199.)

Indian Mahometan writers merely copy the Arabians, and we have met with no mention of Darnel by Hindu physicians. In Persia the plant is known as Samuk and Gandum-i-diwáheh "fools' wheat." In Northern India it is called Múchhni "bearded"; it does not appear to be known in the Peninsula or Bengal.

Description.—Annual. Roots a few downy fibres. Stems annual, erect, 3 feet or more in height, stiff, smooth, often branched from the lower nodes. Leaves large, distant; sheaths smooth, striate, ligule short, truncate, blade 5 to 10

inches long, spreading and drooping, ¼ to ½ inch wide, linear, gradually tapering to the acute apex, dark green. Spikelets large, ½ to 1 inch long, 5 to 11 flowered, sessile, laterally compressed, blunt, arranged singly edgewise alternately on opposite sides of the elongated rachis, forming a narrow distichous spike, 6 to 12 inches long; rachis somewhat flexuose, hollowed on alternate sides to receive the spikelets, faintly rough; glumes 2 in the terminal spikelet, nearly equal, only one in the remainder, placed on the outer side of the spikelet, closely appressed, and equalling or exceeding it in length, rather leaf-like, 5-ribbed, convex, smooth, green, subacute, not awned; pales 2, nearly equal in length, the lower rounded on the back, the edges somewhat involute, 5-ribbed, the two outside ribs very strong, obtuse, and membranous at the apex, a little below which arises usually a straight white awn of variable length, the upper pale flat, appressed to the dorsal one, with its margins folded over on the inside, scarious, with two green veins, faintly ciliate on the edges. Lodicules 2, connected at the base, entire. Stamens 3, ovary rounded. Stigmas 2, aspergilliform. Fruit enclosed in the pales (the lower one turgid and thickened), oblong-ovoid, nearly ¼ inch long, blunt, concave on inner surface, pale brown.

Chemical composition.—Filhol and Baillet found the seeds to contain 50 per cent. of starch, albuminoids, and the other constituents found in cereal grains; also a thick, almost concrete green oil, one portion of which was saponifiable, and the other not. It was insoluble in water, but freely soluble in alcohol and ether. The seeds besides contained an extractive substance soluble in water and alcohol. The non-saponifiable portion of the oil they describe as producing tremulousness when swallowed, but without any narcotism; and the extractive as narcotic. Both substances proved fatal to animals.

Ludwig and Stahl, besides starch, gluten, &c., found two acrid oils soluble in alcohol, but insoluble in water; and an acrid bitter glucoside, soluble in water; they attribute the activity of the seeds to the combined influence of these different principles.

The still more recent experiments of Wittstein have convinced him "that the poisonous characters of the seeds are not due to an acid body, nor to a base, but to an indifferent body which is incapable of forming compounds with lead or zinc, and may be completely extracted from the seeds by water or alcohol, and only incompletely by ether."

Dr. P. Antze, who has recently examined the constituents of the plant, both chemically and physiologically, reports (*Arch. f. exp. Path. und Pharm.*, Nov. 1890, p. 126) the isolation of a volatile alkaloid, *loliine,* and *temulentic acid,* which by the action of lime yields a base, *temulentine,* as a decomposition product. Loliine is said to yield good crystalline salts with sulphuric, hydrochloric, oxalic, and acetic acids, but too small a quantity was obtained for analysis. Injected subcutaneously into rabbits it produced a rise in temperature as well as an increase of the pulse, 0·08 gram being a lethal dose, whilst the narcotic and intoxicating action of the lolium plant seems to be due to temulentic acid and the base obtained from it. The acid, which exists to the extent of about 1 per cent. in the seeds, is obtained in crystals melting at 234°C. and possessing the approximate composition $C^{12}H^{23}NO^{10}$, and as well as temulentine yields good crystalline salts. From experiments upon frogs, rabbits, and the investigator himself, it appears to be twice as toxic as loliine and rapidly diminishes the heart's action, but if the depression, which is accompanied by a marked decrease in temperature, is overcome, the patient assumes a condition of high fever. Dr. Antze recommends, in cases of poisoning with darnel grass, the administration of emetics and purges, followed by stimulants to raise the depressed action of the heart. (*Pharm. Journ.*, Jan. 31st, 1891.)

Toxicology.—The symptoms which darnel seeds produce on man are described by Pereira as twofold: "those indicating gastro-intestinal irritation, such as vomiting and colic; and those which arise from disorder of the cerebro-spinal system, such as headache, giddiness, languor, ringing in the ears, confusion of sight, dilated pupil, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. These seeds,

therefore, appear to be acro-narcotic poisons. According to Seeger, one of the most certain signs of poisoning by them is trembling of the whole body." Death has sometimes resulted from their use, but when suitable remedies have been used, such as evacuants and stimulants, the seeds have not proved fatal to man. Recent experiments made by A. S. Wilson of Aberdeen conclusively proved that healthy darnel seeds have no injurious effects. In selecting healthy seeds, Mr. Wilson observed the grains to be frequently affected by ergot and other fungi, and to be also liable to a disease of a more obscure type.

From Dr. P. Antze's experiments it appears that there are two poisonous principles in the diseased seeds, one an acrid poison giving rise to a febrile condition, and the other a narcotic powerfully depressing the heart's action.

In the Report of the Chemical Examiner, N.-W. Provinces and Oudh, for 1879, the occurrence of darnel-poisoning among the men of the Ghoorkha Regiment at Almora, and also among some of his own servants at Nynee Tal, is recorded. He states that the grass is recognised as injurious by the peasantry in the Moozaffarnagar District, where it is called *Mochni.* The symptoms observed were vomiting, headache, and great giddiness ; no fatal cases occurred.

BAMBUSA ARUNDINACEA, *Retz.*

Fig.—*Roxb. Cor. Pl. i., t.* 79 ; *Rheede, Hort. Mal. i., t.* 16. Bamboo (*Eng.*), Bambou (*Fr.*).

Hab.—Throughout India. The young shoots, seeds, and silicious concretion.

Vernacular.—Báns (*Hind.*, *Beng.*), Vánsa (*Guz.*), Vánsa, Kalaka, Tokara (*Mar.*), Mangal (*Tam.*), Bonga, Veduru (*Tel.*), Bidungulu (*Can.*).

Bamboo Manna.—Báns-lochan (*Hind.*), Báns-kápúr (*Beng.*), Vánsa-lochana (*Mar.*), Vánsa-kápúra (*Guz.*), Munga-luppa (*Tam.*), Veduruppu (*Tel.*), Bidaruppu (*Can.*), Moleuppa (*Mal.*).

History, Uses, &c.—The Bamboo, in Sanskrit Vansá and Vénu, is considered by the Hindus to have the hardest of woods. The word also signifies 'spine' and 'lineage,' thus Vánsa-visuddha means "made of a good bamboo," *i.e.*, of a pure or good family, and Vanśa-dhara "carrying a bamboo," *i.e.*, maintaining a family, Vansa-pratishthana-kara "establishing a family on a sure foundation." The Abbé Dubois, in his *Description of India*, states that the young Indian bride and bridegroom are made to stand in two bamboo baskets placed side by side, and the *Kul* or *Arbor generationis* of the caste, at Hindu marriages, is placed in a winnowing fan made of bamboo. The wild tribes of the Garrow hills, who have no temples or altars, set up opposite their huts a bamboo post which they deck with flowers and tufts of cotton, and before it they make offerings to their god. Indian anchorites carry a bamboo stick having seven knots. A bamboo flowering is an event of rare occurrence, and which is supposed to bring in its train all sorts of evil, accompanied by dire distress and famine. The seeds of the bamboo, in Sanskrit Vanśa-tandula, Vanśa-ja, Vénu-yava, Vénu-vija, have often proved of great value in famine seasons, saving thousands of lives; this was the case in Orissa in 1812 and in Canara in 1864. The young shoots which appear towards the end of the rainy season are used as a vegetable; they are minced very finely and soaked in water to remove the bitter taste, and then cooked with *dál*, and seasoned according to taste: they are also made into pickle.

A decoction of the joints of the bamboo is supposed to have an action on the uterus, and is used by females after delivery to cause a free flow of the lochial discharge. The same part of the plant pounded with water is applied to inflamed joints. The juice of the leaves with aromatics is given in hæmatemesis. The leaves are very commonly given to horses by syces as a remedy for coughs and colds.

Bamboo manna is the Vanśa-lochana of the Indian physicians; in the Nirghantás it bears many synonyms, such as Vanśa-rochana, Tvak-kshirá "bark-milk," Vanśa-karpura "bamboo camphor," Vanśa-śarkara "bamboo sugar," Vanśáhva

"bamboo sacrifice," Súbhra, and Sita "white," &c. It is considered to be strengthening, tonic, cold, and sweet; to alleviate thirst, and to avert phthisis, fever, asthma, cough, biliousness, skin diseases, and Váyu (morbid affections of the windy humor). As an example of the way in which it is prescribed, the following formula for making the *Sitopaládi-churna* will be found in Sarangadhara:—Bamboo manna 8 parts, long pepper 4, cardamoms 2, cinnamon 1, sugar 16. Powder and mix. Dose about 60 grains, to be given with honey and *ghi* in phthisis and cachexia.

The belief in the strengthening properties of bamboo manna appears to have originated among the aboriginal tribes of India, as on the West Coast it is the first solid food which the Thana Kolis give their children. The same belief seems to have prevailed in Borneo, as Marco Polo relates that pieces of this substance were let in under the skin by the natives to make the body wound-proof.

We hold with Salmasins that bamboo manna was the substance known to the Greeks as σάκχαρ σάκχαρον, and described by them as a white, concreted or crystalline substance like common salt, because there was no kind of sugar prepared from the sugar-cane, answering to this description, known in India in the time of Dioscorides. The name Śarkara, which signifies "grit, pebbles, sand," was applied by Hindu writers at that time to several substances, *viz.*, *Guda* or molasses in a dry granular state, the only kind of cane-sugar then in use in India; *Yavása-śarkara,* the concrete manna of Alhagi; and *Vanśa śarkara,* the concretion found in the bamboo. The Sanskrit name Khanda was also applied to Guda, which is the substance known in the vernaculars as Gúr or Gúl, and is still the kind of sugar most used by the Hindus. Pale crystalline sugar, the *Chini* of the bazars, does not appear to have been known until some 400 years after the date of Dioscorides.

Under the name of Tabáshir, a corruption of the Sanskrit Tvak-kshira, bamboo manna was known to the early Arab travellers in the East; the port of Thana, on the West Coast of

India, was famous for its Tabáshir in the time of Idrisi (1135) and supplied it to all marts. Ibn Sina describes Tabáshir as astringent and stomachic, useful in erysipelas and to allay thirst in bilious dyspepsia, cardiacal, and strengthening. As a local application it is used to relieve the heat and irritation caused by aphthous eruptions along with pounded rose leaves. Later Mahomedan writers upon the Materia Medica of the East have added nothing of importance to Ibn Sina's account of the drug. Flückiger (*Zur Geschichte des Tabaschir, Zeit. des allg. österr. Apoth. Ver.* Nr. 14 u. 15, 1887) mentions a list of Indian goods on which transit duty was levied at Aden in 1270; in it Tabáshir is mentioned together with tamarinds and camphor. He also draws attention to a remarkable connection between Tabáshir and ivory ashes, generally known by the name of *Spodium*. Idrisi, in the middle of the 12th century, points out that the latter was used to adulterate the former, while others of a different opinion assign a greater value to Spodium. Garcia d'Orta (*Colloquios* 51) mentions both Tabáshir and Spodium, which he considers to be Pompholyx or Turtia (white of zinc? calamine?), and states that in Persia and Arabia Tabáshir was generally paid for by its weight in silver ("o preço ordinario na Persia e Arabia é a peso de prata"); he also describes black or grey Tabáshir, which was of less value and was obtained by burning the bamboo cane. Flückiger remarks that it is most likely that the name "Spodium da canna" was given to this black Tabáshir or perhaps to the ashes of the cane, and that it might be owing to this circumstance that in later times the name Spodium came to be applied to animal charcoal (bone-black). The idea of black seems not to have been connected with the original Greek name σποδὸς (ashes). Flückiger also draws attention to the Latin translation of a Persian *Karabádin* or Pharmacopœia by the Carmelite Friar P. Angelus, published in Paris in 1681, in which Tabáshir is spoken of as *pseudo-spodium, anti-spodium,* and *spodium-arabicum.* Rheede as well as Rumphius notice Tabáshir, but it does not appear to have attracted much attention in Europe until Dr. Patrick Russell drew the attention of the Royal Society to it, and induced

James Louis Macie to make an analysis, which showed that it consisted principally of silica.

Further information on Tabáshir may be obtained from Prof. Flückiger's papers above mentioned, and a paper by Dr. Brandis in the *Indian Forester*, March, Vol. XIII.

Description.—Tabáshir consists of irregularly-shaped fragments of an opaque white or bluish opalescent colour, the larger pieces are about an inch in diameter, concavo-convex, and have evidently derived their form from the joint of the bamboo in which the deposit has collected. The raw article is blackened and dirty, having apparently been obtained by burning the bamboos, or on account of the presence of insects; to make it fit for use it is calcined, when it becomes perfectly clean.

Chemical composition.—Cavendish (*Ebenda,* 370) determined the specific gravity of Tabáshir to be 2·169 at 11·4°C.

Humboldt remembered the analysis of Macie when he and Bonpland discovered a similar substance at the volcano of Pichincha, not far from Quito. He wrote from Mexico on the 22nd of April 1803 to Antonio Joseph Cavanilles, Director of the Botanic Garden at Madrid (*Annales du Muséum,* iv. (An. xii., 1804), 478)—"Vous vous souvenez sans doute de cette substance siliceuse, ressemblante à l'opale que M. Macie analysa en Angleterre. Nous l'avons découverte à l'ouest du volcan Pichincha, dans les bambous ou gros roseaux appelés *Guaduas* dans le royaume de Santa Fé. J'ai fait des expériences chimiques sur le sue de cette graminée colossale, avant que la substance siliceuse se fût déposée, et j'y ai remarqué des phénomènes très-curieux; il est susceptible d'une putréfaction animale, et paraît annoncer une certaine combinaison d'une terre simple avec l'azote." The *Guaduas* are the representatives of the Indian bamboos in South America and closely related to them. The specimen of American Tabáshir which Humboldt sent to Paris was examined by Fourcroy and Vanquelin (*Ann. du Mus.*, vi. (1806), 382—385); they found, besides 70 per cent. of silicic acid, 30 per cent. of potash and lime. It would be interesting to know if it was perhaps a

silicate, which seems possible, as they mention traces of crystallization. The remarkable optical properties of this amorphous silicic acid attracted the attention of Brewster (*Trans. Roy. Soc. London* (1819), i., 283—299), who found it to possess very little power of refracting light, and to show when heated in the dark a brilliant phosphorescence. The information concerning its physical properties given by Brewster was, however, partly contradicted, and, as it seems, with reason, by Guibourt in 1885. Edward Turner (*Ebenda*, pp. 335—338) found that the substance examined by Brewster could easily be dissolved in a solution of caustic potash, even after having been heated; the silicic acid separated from the solution, after being heated to redness, weighed nearly as much as the quantity of Tabáshir examined. The transparency which Tabáshir acquires when immersed in water was noticed by Brewster and Guibourt; this property is still more striking when it is immersed in a volatile oil or liquid paraffin, for then with very pure specimens the outlines are scarcely to be distinguished. Guibourt determined its sp. gr. in water to be 2·149 at 4°C., and found Indian Tabáshir to be composed of 97·39 per cent. of silicic acid, 2·9 per cent. water, with traces of potash and lime.

In 1859 Flückiger (*Schweizerische Zeitsch. f. Pharm.*, 1859, 244) examined a very fine specimen of Tabáshir from Java, where it is known by the name of *Batugining*, and found it to be almost pure silicic acid. It would appear, however, to be sometimes mixed or adulterated with the ashes of the cane, as Rost van Tonningen (*Jahresb. der Chem.*, 1860, 531) found a specimen to contain silicic acid 86·38, water 7·63, oxide of iron, potash, and lime 5·99 per cent.

The careful examination of Tabáshir made by Poleck (*Zeitsch. des österr. Apoth. Ver.*, 1887, p. 139) shows beyond doubt that it may be considered to be silicic acid, although the question remains open, whether it is the normal acid $Si(OH^4)$. (Flückiger, *Zur Geschichte des Tabaschir, Zeitsch. des allg. österr. Apoth. Ver.* Nr. 14 u. 15, 1887.) As regards the variations observed in the amount of water contained in this substance, the reader is referred to our remarks under *Commerce*.

The ash of bamboo stems has been analysed by Hammerbacher with the following results: SiO^2, 28·264; CaO, 4·481; MgO, 6·569; K^2O, 34·217; Na^2O, 12·765; Cl, 2·062; SO^3, 10·705; Ferric phosphate, 0·037=99·100. The ash is rich in silica and alkalis, poor in alkaline earths. The proportion of alkalis is about the same as in the ashes of ordinary roots. (*Liebig's Annalen*, clxxvi., 87.)

Commerce.—Bombay appears to have inherited the ancient trade in Tábáshir which formerly centered in Thana. The raw article is, however, now obtained from Singapore, and is probably the produce of Java and other islands of the Eastern Archipelago. The Indian bamboos being under the protection of the Forest Department prevents their being destroyed to obtain Tabáshir, besides they are of much more value for other purposes. The Bombay trade in this article is now the monopoly of a Mahometan, who is the sole importer of the raw material, which he calcines and afterwards sells in bulk at Rs. 2-10 per lb. He also sells a selected quality at Rs. 4 per lb., and an inferior quality at Re. 1-4. The method of calcination is a trade secret. After it has been calcined, Tabáshir is placed in water, which it absorbs and increases greatly in weight, becoming cold to the touch; this fact is pointed out to the purchaser as a proof of its cooling qualities. The water is retained by the drug for a long time.

SACCHARUM OFFICINARUM, *Linn.*

Fig.—*Woodville, t.* 266; *Tussac, Fl. Antilles, i., tt.* 23—25; *Bentl. and Trim., t.* 298. Sugar-cane (*Eng.*), Canne à sucre (*Fr.*).

Hab.—India. Cultivated in all warm climates. The juice and root.

Vernacular.—Úkh, Ganna (*Hind.*), Âk (*Beng.*), Ús (*Mar.*), Shéradi (*Guj.*), Karumbu (*Tam.*), Cheruku (*Tel.*), Karimpa (*Mal.*), Khabbu (*Can.*).

History, Uses, &c.—If the wild form of the sugar-cane is to be anywhere now met with, it is in India, of which country it is undoubtedly a native, and where it has been cultivated from the earliest antiquity. Whether the species grown in China, *S. sinense* (Roxb.), is specifically the same is scarcely determined with certainty, but it is probably native in that country. (*Bentl. and Trim.*) The Sanskrit name of the plant is Ikshu, and it is also called Guda-trina, "the grass from which *guda* is made," and Guda-dáru, &c.; from the juice (Ikshurasa) the ancient Hindus prepared an extract by boiling, which, when soft and sticky, was called Ikshurasa-kvátha, Phánita, and Guda, but when allowed to drain and become dry was known as Guda-śarkará, Khanda or Khanda-sarkára, and Matoyandika. Twelve varieties of sugar-cane are mentioned by Sanskrit writers, but in this number are probably included other grasses belonging to the genera *Saccharum*, *Sorghum*, &c. The root of the sugar-cane is also used in Hindu medicine, and is considered to have demulcent and diuretic properties. It is an ingredient along with the roots of *Saccharum sara*, *S. spontaneum*, *Eragrostis cynosuroides*, and *Cynodon dactylon* in the compounds known as *Trinapancha-mula* and *Kuśa-valeha*, which are much prescribed as adjuncts to metallic medicines in gonorrhœa and other affections of the urinary passages. A kind of rum was also obtained by the ancient Hindus from the juice of the cane or from *guda* and water fermented, which was known as Sidhu and Ganda.

The unrefined, dark-brown Guda or Phánita of the Hindus was known to the ancient Persians as پانیذ (Pániz) and شکر (Shakar); from it they manufactured the dry crystalline sugar which they call کند (Kand) or نبات (Nabát), now generally written قند by both Arabs and Persians. We have already stated (see Article on Bambusa) our reasons for believing that the σάκχαρον of Dioscorides was not cane-sugar, *viz.*, that no such article as sugar in a dry crystalline state was known in India at that time, the only kind of sugar used by the Hindus being the dark-brown mass known as *guda*, and which is still the kind of sugar most popular in India. This substance, as well

as the *guda* prepared from the palm (φοίνιξ), was called by the Greeks μέλι (honey), and is mentioned by Herodotus, Theophrastus, Seneca, Strabo, and other early writers as "Honey of Canes" and "Honey made by human hands." The vernacular names Misri, "Egyptian," for refined sugar, and Chini, "Chinese," for sugar-candy, point to these crystalline forms of sugar as comparatively recent introductions into India, and at the present time the sugar-candy of Indian commerce is chiefly imported from China. When we consider that the sugar-cane was known to the ancients from the time of Nearchus, it is hardly reasonable to suppose that Pliny could be so ill-informed as to speak of Saccharum, if by that name he meant cane-sugar, as only employed in medicine. Lucan, writing about the same time, was aware that the Hindus drank the juice of the cane:

"Quique bibunt tenera dulces ab arundine succos."

At the present day, the cane-presser, with his primitive press, is a familiar personage at Indian fairs, where he dispenses the luscious juice to his customers at about twopence a pint.

Sugar, under the name of Shi-mi "stone honey," is frequently mentioned in the ancient Chinese annals among the productions of India and Persia; and it is recorded that the Emperor Tai-tsung (A.D. 626—650) sent an envoy to the kingdom of Magadha in India, to learn the method of manufacturing it. (*Bretschneider, Chinese Botanical Works*, 1870, 46.) The Chinese acknowledge that the Indians between A.D. 766 and 780 were their first teachers in the art of making sugar. An Arabian writer, Abu Zaid-el-Hasan, states that about A.D. 850 the sugar-cane was growing on the north-eastern shore of the Persian Gulf; and in the following century, the traveller Ali Istakhri found sugar abundantly produced in the Persian Province of Kuzistan. About the same time (950) Moses Chorenensis stated that the manufacture of sugar was flourishing near the celebrated school of medicine at Jondisabur in the same province, and remains of this

industry in the shape of millstones, &c., still exist near Ahwas.

Persian and Arabian physicians of the 10th and 11th centuries, such as Rázi, Ali Abbás, and Ibn Sina, introduced sugar (سكر Sukkar) into medicine. The Arabs cultivated the cane in many of their Mediterranean settlements, as Cyprus, Sicily, Italy, Northern Africa, and Spain. The Calendar of Cordova shows that as early as A.D. 961 the cultivation was well understood in Spain, which is now the only country in Europe where sugar-mills still exist.

The importance of the sugar manufacture in the East was witnessed by Marco Polo, Barbosa, and other European travellers; and the trading nations of Europe rapidly spread the cultivation of the cane over all the countries of which the climate was suitable. The ancient cultivation in Egypt, probably never quite extinct, was revised on an extensive scale by the Khedive Ismail Pasha. (*Pharmacographia.*)

Sugar is of comparatively little value for its independent effects, but few substances are more useful as an associate of other medicines, whether to preserve them from oxidation and decomposition, to conceal or improve their taste, or to give them special pharmaceutical forms.

In solution sugar is almost exclusively lenitive, but in powder it is stimulant. It is universally employed to diminish dryness of the mouth and fauces, to allay irritation, and to mitigate cough and hoarseness. Sugar dissolved in water is said to have a diuretic effect. When injected into the veins of animals it is said to be powerfully diuretic (Richet and M. Martin, *Med. Record,* xxi., 394). It certainly, when moderately used, promotes digestion and allays nervous excitement. For these purposes sweetened water (*eau sucrée*) is universally employed in France and Southern Europe. Formerly a strong solution of sugar was much used as an antidote to corrosive poisons. It enters into all the drinks, mucilaginous, farinaceous, and gelatinous, employed in febrile diseases. Finely-powdered sugar will sometimes relieve the hiccough, which, in

nursing infants, is apt to arise from over-feeding. Loaf-sugar, eaten freely, is said to arrest the development of alcoholic intoxication, perhaps by retarding gastric absorption. A strong solution of sugar injected into the rectum has been used successfully to destroy ascarides of that part. In powder it is very efficient as a remedy for aphthæ of the mouth, in repressing the exuberant and stimulating the indolent granulations of ulcers, in removing opacities of the cornea, and in curing granular eyelids. Sugar has been claimed by Fischer to be an efficient antiseptic dressing for wounds. He associated it, however, with other antiseptics; but Windelschmidt states that for small wounds sugar is equal to iodoform as a dressing (*Med. News*, xliii., 462). In chronic laryngitis, when inhaled by a sudden aspiration from a tube extending to the root of the tongue, it may be used with advantage alone or mixed with other powders. In the same manner it may be employed as a snuff in chronic ozæna. The fumes from burnt sugar destroy offensive effluvia, and are conveniently disengaged by sprinkling sugar upon burning coals or on a hot shovel. (*Stillé and Maisch.*) We have already referred to the use of sweetmeats by opium-eaters to counteract the effects of the drug (p. 96, Vol. I.).

Cultivation.—The sugar-cane season comprises nearly a twelvemonth. The land chosen is usually a good loam or light clay manured. The leafy ends of the preceding season's canes are cut off, or the whole cane is chopped into pieces so as in any case to include two nodes or joints, and these, to the number of about 20,000 per acre, are planted in furrows in January and February. The land is irrigated occasionally from this time to the commencement of the rains. The harvest begins in the beginning of December, and the cutting and crushing of the canes and boiling of the juice is carried on till January and February. Excepting the few mills under European management, the crushing and boiling is performed by primitive, and, therefore, rude processes. The average outturn per cent. of cane in the North-West Provinces is stated by Messrs. Duthie and Fuller to be as follows: 100 of canes=15

of juice=18 of *guda* (unrefined sugar) or 17·5 of *shakar* * (dry, unrefined sugar), or 19·5 of *ráb* (syrupy sugar). The natives generally manufacture the juice into the two kinds of *guda*, called in the vernaculars *gúra* or *gúla*.

Description.—The transverse section of a sugar-cane exhibits numerous fibro-vascular bundles, scattered through the tissue, as in other monocotyledonous stems; these bundles are most abundant towards the exterior, where they form a dense ring covered with a thin epidermis, which is very hard from the quantity of silica deposited in it. In the centre of the stem the vascular bundles are few in number, and traverse an abundant parenchyma which contains in its thin-walled cells an almost clear solution of sugar, with a few small starch granules and a little soluble albuminous matter. The latter is found in larger quantity in the cambial portion of the vascular bundles. The walls of the medullary cells contain pectic matter, but not in sufficient quantity to cause them to swell much in water. (*Wiesner.*) The unrefined sugar of India (gúra or gula), often incorrectly termed molasses, occurs in two forms in the bazars—one is a blackish sticky mass without evident crystalline structure, the other is a dark-brown partly crystalline mass which crumbles on pressure, and is generally spoken of by the dealers as floury *gúr* or *gúl*—the first contains the whole of the uncrystallizable portion of the syrup, in the other most of this has been drained off. Indian molasses or treacle is of a very dark colour, of a peculiar sharp flavour, and has a bitterish after-taste caused by the presence in it of caramel or burnt sugar, produced during the careless evaporation of the cane juice. It is hardly suited for pharmaceutical purposes, and as sold in the bazars is generally freely watered and in a state of fermentation. The refined sugars of Indian commerce are manufactured on the European system, chiefly in Bengal, or are imported from Mauritius, and,

* Called by Europeans *Jaggery*, a corruption of the Sanskrit Sarkara, which in Ceylon is the vernacular name for unrefined sugar in the corrupted form of Shakkare.

in the case of loaf-sugar, from France. They differ in no respect from the sugars of European commerce.

Chemical composition.—The sugar-cane is, when mature, composed of cellulose 8 to 12 per cent.; sugar 18 to 21; water, including albuminous matter and salts, 67 to 73. Of the entire quantity of juice in the cane, from 70 to 84 per cent. can be extracted by crushing and pressing, and yields in a crystalline state about three-fifths of the sugar which the cane originally contained. The juice has on an average the following composition:—

Albuminous matters	0·03
Granular matter (starch?)	0·10
Mucilage containing nitrogen	0·22
Salts, mostly of organic acids	0·29
Sugar	18·36
Water	81·00
	100·00

There is also present in the juice a very small amount of a slightly aromatic substance (essential oil?) to which the crude cane-sugar owes a peculiar odour which is not observed in sugar from other sources. (*Pharmacographia.*) Sugar, $C^{12}H^{22}O^{11}$, may be obtained in large transparent rhombic prisms, known as *sugar-candy*, which does not differ from lump-sugar, except that the latter is in crystalline masses from disturbed crystallization. Sugar has the specific gravity 1·58 (*Kopp*), is permanent in the air, neutral, without odour, has a very sweet taste, and dissolves at ordinary temperatures in one-half its weight of water, yielding a dense, sweet, and colourless liquid known as syrup; saturated at 15° C. such a solution contains 66 per cent. of sugar, and this has the density 1·345082 (*Michel and Kraft*). At the boiling-point sugar dissolves in water almost in all proportions. It requires

for solution about 80 parts of boiling absolute alcohol, 28 parts of boiling officinal alcohol, and about 4 parts of boiling alcohol, spec. grav. ·830, these solutions depositing most of the sugar on cooling. The solubility is greater in weak alcohol, both cold and hot. At 15° C. 1 part of sugar dissolves in 2 parts of 50 per cent. alcohol, in 7·7 parts of 75 per cent. alcohol, in 14·7 parts of 80 per cent. alcohol, in 31·6 parts of 85 per cent. alcohol, in 175 parts of 92 per cent. alcohol, and in 228 parts of methylic alcohol of the same strength (*Casamajor*). Sugar dissolves also in glycerin, the solubility being increased on dilution with water, but it is insoluble in ether, chloroform, carbon disulphide, and in hydrocarbons. It combines with chloride of sodium, yielding deliquescent crystals which contain 14·9 per cent. of that salt. Definite compounds have likewise been obtained with several other salts and with alkalies and alkaline earths. When triturated in the dark it becomes luminous. Its solution deviates polarized light to the right—a behaviour which is of great practical importance for the estimation of sugar in aqueous liquids and for distinguishing different kinds of sugar which have a different rotary power.

When sugar is heated to 160° C. it melts without losing in weight, and congeals on cooling to a transparent amorphous yellowish mass known as *barley-sugar, saccharum hordeatum,* which becomes gradually opaque on the surface from the formation of minute crystals. If sugar is kept in the melted state between 160° and 170° C. for a short time, it is converted into a deliquescent mixture of *glucose* and *levulosan*; $C^{12}H^{22}O^{11}$ yields $C^6H^{12}O^6 + C^6H^{10}O^5$; the latter is not fermentable until after it has been boiled with water or dilute acids. When heated to between 180° and 200° C. sugar turns brown, evolves a peculiar odour, and is converted into *caramel,* $C^{12}H^{18}O^9$, parting at the same time with $2H^2O$; the pure product of this composition, *caramelan,* was obtained colourless by Gélis (1862). Caramel may be prepared in the same manner from inferior qualities of sugar, from molasses, and from glucose, and the conversion is hastened in the presence of small quantities of alkalies; the addition of a little carbonate of ammonium, which

is again volatilized by the heat, is of service, for the reason stated. Subjected to dry distillation, sugar yields aldehyd, acetone, acetic acid, tarry products, and carbonic acid, carbonic oxide, and marsh gas. According to Lassaigne, iodine heated with solution of sugar is converted into hydriodic acid. Under the influence of ferments, as well as of dilute acids, cane-sugar is converted into *invert-sugar,* which is a mixture of *dextrose* or grape-sugar and *levulose* or fruit-sugar, and is directly fermentable. This inversion of sugar takes place slowly on boiling with water, but cold aqueous solutions keep unaltered for a long time, provided the access of ferments suspended in the air be prevented. Under the same condition, according to the investigations of Kreusler, Lemoine, and others, light does not exert the inverting effect reported by Raoul (1871). Nitric acid inverts cane-sugar, readily, and when heated with it produces saccharic, racemic, tartaric, and oxalic acids.

Tests.—The purity of cane-sugar is ascertained by the physical properties described above and by its complete solubility in water and alcohol. The absence of glucose or of a similar sugar is ascertained by some of the reactions given below. "Aqueous and alcoholic solutions of sugar should have no effect on litmus-paper. The solution in 20 parts of distilled water should be scarcely rendered turbid by silver nitrate or barium nitrate (chloride and sulphate)." Neither an aqueous nor an alcoholic solution of sugar kept in large, well-closed, and completely-filled bottles should deposit a sediment on prolonged standing (absence of insoluble salts, foreign matters, ultramarine, Prussian blue, &c.). If a portion of about 1 Gm. of sugar be dissolved in 10 cm. of boiling water, then mixed with 4 or 5 drops of test solution of nitrate of silver and about 2 cm. of water of ammonia, and quickly heated until the liquid begins to boil, not more than a slight coloration, but no black precipitate should appear in the liquid after standing at rest for 5 minutes (absence of grape-sugar and of more than a slight amount of inverted sugar). (*Stillé and Maisch.*)

Commerce.—The following statistics of the trade in Sugar are taken from the Reports on the inland trade of the different provinces and on the trade by sea:—

ARTICLES.	Value in lakhs of Rupees.				Quantity in thousands of cwts.				
	1888-89.	1887-88.	1886-87.	1885-86.	1888-89.	1887-88.	1886-87.	1885-86.	Weight.
Sugar, refined...	10	4	4	3	144	38	33	25	cwts.
Do. unrefined.	45	42	46	50	869	1,009	953	1,143	,,
Total ...	55	46	50	53	1,013	1,047	986	1,168	cwts.
Sugar, refined...	...	18	20	21	...	150	158	163	cwts.

ORYZA SATIVA, *Linn.*

Fig.—*Bentl. and Trim., t.* 291; *Rheede, Hort. Mal. v.,* 196—201. Rice (*Eng.*), Riz (*Fr.*).

Hab.—Throughout India, wild and cultivated. The grain, spirit, and vinegar.

Vernacular.—Dhán (*Hind., Beng.*), Bhát (*Mar.*), Chokha (*Guz.*), Arishi (*Tam.*), Biyyam (*Tel.*), Akki (*Can.*).

Husked Rice.--Chával (*Hind., Beng.*), Tándula (*Mar.*).

History, Uses, &c.—Wild rice was probably used by the aboriginal tribes of India in prehistoric times; it is still carefully collected by the peasantry, who consider it to have special virtues, and call it "god's rice," "hermit's rice," &c. Rice (व्रीहि vríhe) is not mentioned in the *Rig-Veda*, but in the *Atharva-Veda* it is noticed along with barley, másha (*Phaseolus Roxburghii*), and sesamum. Rice cultivation in India appears to have been subsequent to that of China and Burma. Girard de Rialle, in his *Mythologie comparée*, states that the Karens of Burma believe that every plant has its *là* or *kelah* (spirit). The rice has its spirit, and when the crop is bad, they pray to it

in the following terms: "Come, O spirit of the rice, come back! come to the rice-field, come to the rice! come from the East, come from the West, come from the beak of the bird, from the mouth of the monkey, from the throat of the elephant, come from the grain stores! O *kelah* of the rice, return to the rice!" In Siam they offer rice and cakes to trees before cutting them down. In Bengal sacrifices of rice are made to the Bael tree, probably a survival of an ancient fetish worship which the Brahmins have sanctioned by deifying the tree.

Rice plays an important part in the marriage ceremonies of the Hindus. According to the Grihya-sutra of Asvalayana, the bride must walk three times round the altar, and at the completion of each turn make an offering of rice. This ceremony resembles an ancient form of marrying among the Romans, in which an offering of a cake made of *fár* (spelt)* was made in the presence of the Pontifex Maximus or Flamen Dialis and ten witnesses.

Parched rice, *Lájá*, also called *Syálá* (*Sya* "a winnowing fan," and *lá* for *lájá*), is scattered by the bride's brother at marriages. Rice is poured over the head of the bride and bridegroom as an emblem of life, regeneration and plenty. On the fourth day of the marriage ceremonies the young couple eat rice together for the first and only time in their lives, and on the last day they both celebrate together the Soma sacrifice, when they throw *lájá* into the fire. At the birth of a child the father places the red Akshata rice on its forehead to avert evil, and when the child is named it is placed on a cloth covered with rice. Rice is also used in some parts of India to detect witches: a small bag of rice, bearing the name of each of the suspected parties, is placed in a white-ants' nest, and the one they first eat is considered to belong to the guilty party. When several persons are suspected of a crime, rice is sometimes used to detect the guilty one— For this purpose the persons are required to chew rice, the criminal being discovered by his inability to properly masticate

* *Triticum Spelta*, Linn., or German wheat.

it, owing probably to fear checking the free flow of saliva. Vincenzo Maria da Santa Caterina mentions in his travels that rice and turmeric are offered in India to the gods to obtain children and the cure of female diseases, and that young girls make a vow to offer rice, should they obtain a good husband. In the consecration of the Brahmachari, the father of the youth carries in his hands a cupful of rice, and the assistants after the bath cover the candidate with rice. Asvalayana says that the disciple asks alms to learn the Vedás; he obtains the rice as alms and must cook it before sunset. His commentator, Narayana, adds that when the rice has been cooked, the disciple should say to his master, "the food of the pot is ready." In sacrifices to Rudra, according to Asvalayana, the husk of rice was thrown into the fire along with the smallest grains, and the tail, skin, head, and feet of the animal, and that the latter before being killed was sprinkled with rice and barley-water.

In times of fasting and penitence, grains of rice and barley are watered and blessed and offered to the gods. In funeral ceremonies rice and other food is offered to crows. According to Manu, the twice-born are directed to offer five great sacrifices, *viz.*, with wild rice (Nivára), with various pure substances, or with herbs, roots, and fruits.

The practice of worshipping the new rice at the time of the harvest is common throughout India. In Bengal, on a Thursday, in the month of Pansha (December-January), after the crop has been reaped, a rattan-made grain measure called *rek*, filled with the grain upon which are placed gold, silver and copper coins and some cowrie shells, is worshipped as the representative of the goddess of fortune. This worship is repeated in the months of Chaitra, Sravana, and Kártika. In Western India the new rice is worshipped at the Dasara and Devali festivals, and in Madras the same event is celebrated by the *Pongol* ceremony, when the new rice is boiled for the first time and eaten with great rejoicings. Among the Native Catholics the same ceremony is perpetuated in the "blessing of the new rice," which is done by the priest in the field before the crop is cut.

That the cultivation of rice had widely spread in the time of Alexander (400 B.C.) we learn from Strabo, who says, "according to Aristobulus, rice grows in Bactriana, Babylonia, Susida," and he adds, "we may also say in Lower Syria." Further on he notes that the Indians use it for food, and extract a spirit from it. The Greek names for rice are derived from the Sanskrit *Vrihi*; the earliest form occurs in a fragment of Sophocles, where rice-bread is called ὀρίνδης ἄρτος; in later writers we meet with the form ὄρυζα. The Arabic names have the same derivation, the oldest form being Runz, occurring in the local dialect of the Abd-el-Kais, near Bahrain, and the more modern forms Aruzz and Ruzz. In Persian the form of Birinj is current, as well as the Sanskrit name Shâli, for unhusked rice. Dioscorides briefly mentions rice as being of little nutritive value and apt to cause costiveness. Celsus (ii., 20) classes it along with wheat and spelt as "res boni succi." According to Sanskrit writers, the best class of grains includes wheat, rice, and barley only, other kinds being relegated to the class *Kshudra dhánya* or inferior grains. The preparations of rice used in the diet of sick people, and described in Sanskrit medical works, are:—

यवागु (yavágu) or powdered rice boiled with water. It is made of three strengths, namely, with nine, eleven, and nineteen parts of water, called, respectively, *Vilepi*, *Peyá*, and *Manda*. Instead of water, a light decoction of some aromatic and carminative drug, such as ginger or pepper, may be used in preparing *yavágu*.

लाजा (lájá) or unhusked rice parched in hot sand. It is used as light and digestible diet for the sick.

भृष्टतण्डुल (brishta tandula) or husked rice parched in hot sand. It is used for the same purposes as *lájá*.

पृथुका (prithuká) or unhusked rice moistened, parched, and afterwards flattened and the husk removed. It is soaked in water or boiled and given with curdled milk as an astringent diet in diarrhœa or dysentery.

पायस (páyasa) or rice-milk. A well-known preparation.

तण्डुलाम्बु (tandulámbu) or water in which unboiled rice has been steeped. This is often used as a vehicle for powders, &c., and as a diet drink.

Rice is the staple-food of the inhabitants in Bengal, many parts of Madras, Burma, and the Western Coast of India, but not of the central and northern parts of the country, where wheat and millet are the staples and rice only a luxury.

Fermented and distilled rice liquors are largely used in many parts of India. For an account of the economic uses of the grain, its cultivation, and the numerous varieties of the plant met with in different parts of the country, we must refer the reader to a diffuse but interesting article by Dr. G. Watt in the *Dictionary of the Econ. Prod. of India.*

Chemical composition.—Rice has been examined by Letheby, Payen, and others. Payen gives the percentage composition of dried rice, as, nitrogenous matter 7·55, carbohydrates 90·75, fat 0·8, and mineral matter 0·9. In chemical composition rice closely resembles the potato; one hundred parts of dried potato, according to Letheby's analysis, contain, nitrogenous matter 8·4, carbohydrates 88, fat 0·8, and saline matters 2·8 parts per cent.

Church (*Food Grains of India*) gives the following percentage composition of cleaned rice:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6. Professor Church remarks, 100 parts of rice contain no more than ·065 of potash and ·284 of phosphoric acid. König quotes 20 analyses of rice by various chemists, the mean percentage composition being, water 13·11, albuminoids 7·85, fat ·88, nitrogen-free extract and starch 76·52, cellulose ·63, ash 1·01. Where rice constitutes almost the entire food of the population, the throwing away the water in which it has been boiled involves the loss of some of the mineral matter, and is to be deprecated; no more water should be used in cooking this grain than can be absorbed by it. Two pounds of cleaned rice weigh 5 pounds after boiling.

Commerce.—The following table shows the exports of Rice (husked) from India during the last ten years in thousands of cwts :—

Year.	Burma.	Bengal.	Madras.	Bombay.	Sind.	Total.	Value in lakhs of Rupees.
1880-81......	16,730	6,717	2,363	927	32	26,769	89,717
1881-82......	16,690	7,617	1,549	614	49	28,519	82,496
1882-83......	21,249	7,838	1,319	552	71	31,029	84,401
1883-84......	16,994	7,394	1,843	521	80	26,832	83,289
1884-85......	13,507	6,035	1,403	677	80	21,702	71,228
1885-86......	19,084	6,879	1,181	521	149	27,814	91,672
1886-87......	18,216	5,902	1,564	639	139	26,460	87,648
1887-88......	17,879	7,996	1,438	764	72	28,149	92,251
1888-89......	14,205	6,417	1,538	589	19	22,768	78,453
1889-90......	18,259	5,992	1,654	799	70	26,774	100,473
Average for 10 years...	17,491	6,878	1,585	660	76	26,681	86,162

The estimated total production of rice in 1888-89 has been given as :—

Bengal	14,269,223	tons.
Madras	2,693,916	,,
Bombay and Sind	399,757	,,
N.-W. Provinces and Oudh ..	2,420,768	,,
Punjab	271,293	,,
Central Provinces..............	1,622,385	,,
Burma	3,039,397	,,
Assam.............................	608,846	,,
	25,325,585	tons.

In the same year India imported from beyond its frontier 1,151,450 cwts., the greater portion coming from Nepaul. Of the exports, about 50 per cent. goes to Europe, 30 per cent to Eastern ports, and the remainder for the use of the emigrants in Mauritius, Rèunion, the West Indies, South America, and

Australia. The fine rice of the West Indies is considered insipid by the Indian labourers.

TRITICUM SATIVUM, *Lam.*

Fig.—*Bentl. and Trim.*, *t.* 294. Wheat (*Eng.*), Blé (*Fr.*).

Hab.—The Euphrates region. Cultivated in N.-W. India, the Central Provinces, and Bombay.

Vernacular.—Géhun (*Hind.*), Gahun (*Mar.*), Godumai (*Tam.*), Godumulu (*Tel.*), Kotanpam (*Mal.*), Godhi (*Can.*), Gam (*Beng.*), Ghavum (*Guz.*).

History, Uses, &c.—Wheat, as the most important of the cereals, has given rise to numerous myths, for an account of which we cannot do better than refer the reader to the late Dr. W. Mannhardt's learned monograph *Die Komendämonen* (Berlin, 1868). In the myth of Persephone-kora, daughter of Zeus, the god of the heavens, which by their warmth and rain produce fertility, and of Dimeter or Ceres, the maternal goddess of the fertile earth, we perceive that she was conceived as a divine personification of this grain, in summer appearing beside her mother in the light of the upper world, but in the autumn disappearing, and in winter passing her time, like the seed under the earth, with the god of the lower world. As a pendant to the Greek myth, we have the Indian myth of Sita or "the Furrow," husbandry personified, and apparently once worshipped as a kind of goddess. In the *Rig-Veda* Sita is invoked as a deity presiding over Agriculture, and appears to be associated with Indra. In the *Vájasaneya*, Sita "the Furrow" is personified and addressed, four furrows being required to be drawn at the ceremony when certain stanzas are recited. Sita is so named because she was fabled to have sprung from a furrow made by her father Janaka while ploughing the ground to prepare it for a sacrifice instituted by him to obtain progeny, whence her epithet Ayonija "not womb-born."* Wheat was used in sacrifice by the Greeks and

* Of course, these myths are more or less applicable to all food-grains.

Romans, and by the Hindus in Vedic times, as an emblem of fertility; it was poured upon the bride at the marriage ceremony, and in Northern India, wheat, millet and rice are still used on such occasions. Wheat, as the most important food-grain, is frequently mentioned by Hippocrates, who calls it πυρός, and mentions three kinds; Pliny also describes several kinds of *Triticum.* Sanskrit medical writers also mention three kinds of wheat, namely, Mahágodhuma or large-grained, Madhuli or small-grained, and Nihsuki or beardless; they consider it to be the most nutritive of the food-grains, but not so easily digested as rice.

Many varieties of wheat are cultivated in India, and through careless cultivation there is much mixture in the samples brought to market. A number of samples purchased by one of us in the Bombay market and sent to Australia for trial, were, on careful cultivation, found to be all mixed, some of them producing five or six distinct varieties. Indian wheats may be divided roughly into two classes, soft and hard, the former being mostly used for bread-making, and the latter for making a kind of vermicelli and certain other preparations used by the natives. Amongst the Hindus, owing to caste distinctions, the whole process of grinding the corn, separating the flour and making it into cakes, is usually performed by the women of the house, consequently the demand for ready-made flour is limited to the supply of the non-Hindu population, and some of the less particular Hindu castes. In the Indian process of making flour, the wheat, after cleaning, is placed upon a table and thoroughly wetted and the water allowed to drain from it during the night. The next morning, the still moist grain is ground in handmills by women. It is then sifted, and as much fine flour and *rawa* or *suji* (the heart of the grain) as can be obtained are laid aside. The remainder termed "*naka*" is again ground in a more powerful mill and an inferior kind of *rawa* obtained from it. The residue after a third grinding yields a coarse flour and bran. The bazar-made bread is of two kinds, that used by the Mahometans and known as *Nán*, which is in thin cakes, and loaf-bread introduced by the

Portuguese. The former is similar to the bread used in all Mahometan countries, the latter is made with 60 parts fine *rawa*, 20 second sort or *naka rawa*, and 20 of first sort flour. A second or inferior kind of bread is also sold. The barm or yeast in use is, where obtainable, the fermenting juice of the palm, elsewhere an artificial barm is prepared.

In some of the large towns a loaf-bread is now made by Brahmins for the use of the Hindu population, but its use is very limited. In Calcutta, Madras, and Bombay, flour and bread made as in Europe is obtainable, and is gradually taking the place of the Portuguese article. Fine flour is also imported from Europe and America, as the excessive proportion of gluten in Indian flour renders it unsuitable for use in making pastry.

Wheaten flour is often used as a dusting-powder to allay the heat and pain of local inflammations, such as burns, scalds, &c., but it is inferior for such purposes to powdered starch. In America an uncooked paste made of the flour has been used with success in diarrhœa. In India flour is much used by the natives for making poultices.

Description.—The albumen which constitutes the main portion of the grain is composed of large thin-walled parenchyme, the cells of which on transverse section are seen to radiate from the furrow, and to be lengthened in that direction rather than longitudinally. In the vicinity of the furrow alone the tissue of the albumen is narrower. Its predominating large cells show a polygonal or oval outline, whilst the outer layer is built up of two, three or four rows of thick-walled, coherent, nearly cubic gluten-cells. This layer, about 70 mkm. thick, is coated with an extremely thin brown tegument, to which succeeds a layer about 30 mkm. thick, of densely packed, tabular, greyish or yellowish cells of very small size; this proper coat of the fruit in the furrow is of rather spongy appearance.

The gluten-cells, varying considerably in the different cereal grains, afford characters enough to distinguish them with certainty. In wheat, for instance, the gluten-cells are in a

single row, in rice they form a double or single row, but its cells are transversely lengthened.

The layer alluded to as being composed of *gluten-cells* is loaded with extremely small granules of albuminous matters (gluten), which on addition of iodine are coloured intensely yellow. These granules, which, considering barley as an article of food, are of prominent value, are not confined to the gluten-cells, but the neighbouring starch-cells also contain a small amount of them: and in the narrow zone of denser tissue projecting from the furrow into the albumen, protein principles are equally deposited, as shown by the yellow coloration which iodine produces.

The gluten-cells, the *membrane embroynnaire* of Mège-Mouriès, contain also, according to the researches on bread made by this chemist (1856), *Cerealin,* an albuminous principle soluble in water, which causes the transformation of starch into dextrin, sugar, and lactic acid. In the husks (*épiderme, épicarpe,* and *endocarpe*) of wheat, Mège-Mouriès found some volatile oil and a yellow extractive matter, to which, together with the cerealin, is due the acidity of bread made with the flour containing the bran.

Chemical composition.—König quotes 200 analyses of wheat from different sources and by various chemists, and the following figures represent the minimum, maximum, and mean composition:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extractive.	Cellulose.	Ash.
Minimum ..	5·33	7·61	1·00	59·90	1·24	·52
Maximum .	19·10	21·37	3·57	73·77	6·34	2·68
Mean	13·65	12·35	1·75	67·91	2·53	1·81

According to Church (*Food Grains of India*), average Indian wheat has the following percentage composition:—Water 12·5, albuminoids 13·5, starch 68·4, oil 1·2, fibre 2·7, ash 1·7. The albuminoids in some samples examined were as high as 16·7. In English and American wheat they range from 8 to 9 per cent. only. The amount of starch varies between 60 and 70 per cent., and the weight of

nitrogen between 1·6 and 2·7 per cent. A small quantity of saccharine matter is also present, and the ash contains nearly 50 per cent. of phosphoric acid. The inorganic constituents are mostly found in the bran, to the extent of over 7 per cent., while the nitrogenated principles enter chiefly the flour. If the latter be kneaded with cold water as long as the liquid becomes milky, a yellowish gray elastic and glutinous mass remains, which is the *gluten* of Beccaria, retains about 70 per cent. of water, and consists, according to Von Bibra, in the dry state, of about 70 per cent. *vegetable fibrin,* 3·8 to 9·3 *vegetable casein,* 7·5 to 19·5 *glutin,* and 4·6 to 8·2 per cent. of fat. When fresh it dissolves in dilute phosphoric acid and in solution of potassa. On drying it assumes a hornlike appearance and partly loses its solubility. According to Boussingault, it contains 15 per cent. of nitrogen.

To purify it, Ritthausen (1862-67) dissolves it in cold very dilute potassa solution (1 to 1,000 parts of water), decants from the undissolved starch, and precipitates with acetic acid. The precipitate is repeatedly treated with fresh portions of alcohol, commencing with spec. gr. ·914, and increasing the strength finally to absolute alcohol. After another washing with ether, the insoluble portion constitutes *gluten-casein,* which is slightly soluble in acetic acid, freely soluble in potassa, and becomes insoluble by heat. On evaporating the united alcoholic liquids to one-half and cooling, *gluten-fibrin* is separated, which is freed from adhering casein by dissolving it repeatedly in 60 and 70 per cent. alcohol. It is freely soluble in dilute acetic acid, and when boiled with water, in which it is insoluble, it is converted into a jelly. After the separation of gluten-fibrin, the greater portion of the alcohol is evaporated; the precipitate appearing on cooling is treated with a little alcohol, washed with ether, dissolved in a little 65 per cent. alcohol, and precipitated by absolute alcohol. The precipitate is *mucedin*; the solution contains *glutin* or *gliadin.* The former yields with cold or boiling water a milk-like liquid; the latter is soluble in water, alcohol, acetic acid, potassa, &c., the aqueous solution being precipitated by the salts of the heavier

metals; glutin contains sulphur and 18 per cent. of nitrogen. These principles are the most important ones of the *vegetable protein compounds.* (*Stillé and Maisch.*)

Starch forms a white, inodorous, and tasteless powder, with a peculiar slippery feel between the fingers. Exposed to the atmosphere, it contains from 10 to 13 per cent. of moisture, which is given off at 100° C. (212° F.), and is reabsorbed on exposure. The spec. grav. of starch is about 1·5, but after complete drying is increased to 1·56. It is insoluble in ether, alcohol, and cold water; the last-mentioned liquid, however, when triturated with starch, so that some of the granules are ruptured, evidently dissolves a little, since it acquires, after filtration, a blue color on the addition of iodine. *Soluble starch* is obtained, according to Maschke, by the prolonged heating of starch to 100° C. (212° F.). When heated to between 160° and 200° C. (320° and 392° F.), it is gradually converted into *dextrin* (see below). Starch becomes soluble in cold water in the presence of the chlorides of zinc and of calcium and of other deliquescent or freely soluble salts. Its solution in hot water gelatinizes on cooling, the jelly of wheat starch being milk-white—that of potato starch, particularly when made with much water, being more translucent. On heating starch with glycerin a solution is obtained, which, according to Zulkowski (1875, 1880), contains soluble starch, obtainable by diluting with water and precipitating the clear filtrate with alcohol. Potato starch is easily converted into the soluble form, but wheat starch requires a prolonged heating, and rice starch is thus changed with still greater difficulty.

Preparation.—Wheat or other grain is soaked in warm water, to which sometimes an alkali is added, until the outer coating has become soft; it is then ground under water, and washed upon suitable sieves with pure water, with which the starch passes through and is collected by subsidence in suitable tanks, the alkaline water retaining the gluten; or the latter is removed by allowing it to undergo decomposition, when acetic, butyric, or lactic and other acids are produced. The gluten need not be destroyed, but may be obtained as a by-product;

for this purpose wheat flour is made with water into a stiff dough; this is set aside for 2 hours, and then placed upon a fine wire sieve, where it is kneaded under a thin stream of water until the latter no longer becomes milky; nearly the whole of the gluten will remain upon the sieve. After sufficient washing with pure water, the starch is drained in boxes, cut into cubical blocks, and dried in properly-constructed drying chambers.

Mucilage of starch, when heated to about 160° C. (320° F.), or when boiled with very dilute sulphuric acid, or when digested with diastase at about 70° C. (158° F.), is converted, according to Musculus (1860), first into *maltose*, $C^{12}H^{22}O^{11}$, which is probably a compound of *dextrin*, $C^6H^{10}O^5$, and *dextrose*, $C^6H^{12}O^6$, the former passing finally likewise into glucose. Iodine imparts to starch in the presence of water, and to starch-mucilage, a blue color which disappears on the application of heat, but reappears on cooling. Bromine colors the starch brown-yellow. Fuming nitric acid transforms starch into *xyloidin*, $C^6H^9(NO^2)O^5$, which is a white, tasteless powder, insoluble in alcohol, but softening in boiling water. A filtered solution of starch in water yields with tannin a flocculent precipitate which is soluble in boiling water. When incinerated, starch should leave not over 1 per cent. of ash.

The exports of Wheat from India to Europe last year exceeded 1,397,000 tons, an increase on the shipments of the previous twelve months of 725,000 tons, or 110 per cent., and they were larger than the previous largest shipments in any year, that of 1886, by 265,000 tons, or 23·4 per cent. In the past seven calendar years the exports from the three great shipping ports have been as under:—

Years.	From Bombay.	From Kurrachee.	From Calcutta.	Total Tons.
1891	665,543	512,632	219,221	1,397,466
1890	272,644	334,042	65,439	672,125
1889	305,044	341,137	77,637	723,818
1888	483,035	149,277	148,776	781,088
1887	462,428	32,977	229,012	724,417
1886	617,834	186,352	328,558	1,132,744
1885	542,562	307,844	212,277	1,062,683

The shipments from Bombay show an increase on the preceding year of 144·5 per cent., those from Kurrachee of 53·6, and from Calcutta of 236·9 per cent. The share of these three ports in the trade in the past two years and in 1886 has been as under :—

	1891. Per cent.	1890. Per cent.	1886. Per cent.
Bombay... ...	47·6	40·6	54·5
Kurrachee ...	36·7	49·7	15·7
Calcutta ...	15·7	9·7	29·8

Three years ago Kurrachee took the lead, and in the following year she increased it, thanks to the large crops in the Punjab, from whence she draws the bulk of her supplies. Last year the crop in the Punjab, the largest wheat-producing province in India, was a bumper one, and as the demand from Europe was more than usual, the exports from the chief port of Sind were far in excess of any previous year, and exceeded half a million tons. But she was, nevertheless, unable to maintain her supremacy. With full crops in the Central Provinces and in the North-West Provinces and Oudh, but under the average in this Presidency, Bombay once again took the lead with a total of close on 666,000 tons, or about 30 per cent. more than from Kurrachee and a 11 per cent. larger share in the total exports from the country. To the larger crop in the N.-W. Provinces and Oudh the increased shipments from Calcutta are due, for in Bengal the crop was slightly under the mean; but her future position, as an exporter of Wheat, is bound to weaken, rather than improve, on that held by the ports on the Western side. In the past seven years on an average 51 per cent. of the shipments have been despatched to Great Britain and 49 to the Continent, but last year only 41 per cent. went to U. K. Ports and 59 to the rest of Europe. Of the shipments from Bombay in 1891, the Continent received 63 per cent., from Kurrachee nearly as much—*viz.*, 61 per cent.,—but from Calcutta only 41 per cent. went. The crop now growing promises well in the Punjab and North-West Provinces, in both of which the area was recently estimated

as larger than last year: in the former at about one, and in the latter at four per cent. more, or about 10¾ and 11 per cent., respectively, in excess of the normal area. In the Central Provinces and in this Presidency, the estimates, when completed, are expected to fall short of both last year and the average, owing to the season being unfavourable for the later sowings, but in Berar the area is returned at over two per cent. more than last year's. More rain is wanted, especially in the Central Provinces, Berar, and in parts of our own Presidency, and unless it soon falls the outturn will be still further reduced. A large business in Punjab Wheat was done a few months ago for April-May delivery in Bombay, but owing to the dealers in the Central Provinces holding out for new terms of sale in the local market, very little of the grain of those provinces has so far been contracted for. They have only recently given way, and agreed to sell on the old terms, too late, however, for the market has slipped back and prices have dropped considerably from their former high level.

HORDEUM HEXASTICHUM, *Linn.*

Fig.—*Duthie, Fodder Grasses of N. India, Pl. F, f.* 32. Barley (*Eng.*), Orge (*Fr.*).

Hab.—Western temperate Asia. Cultivated in the N.-W. Provinces of India.

Vernacular.—Jav (*Hind.*), Jab (*Beng.*), Java (*Mar., Tel.*).

History Uses, &c.—Indra in the *Rig-Veda* is called *durah yavasya,* "the giver of the barley." At many Hindu ceremonies, such as the birth of a child, marriages, funerals, and in various sacrifices, barley is used. In the *Atharva-Veda* the rice and barley offered to the dead are prayed to to be propitious to them, and in the same *Veda* rice and barley are invoked for the cure of disease and deliverance from other evils: "*Etau yakshmain vi bádhete; etau mun'ch'ato anhasas.*" Barley is symbolic of wealth and plenty; it is also a phallic emblem; Asvaláyana, in the first book of the *Grihyasutra,* says

that in Vedic times, the wife when three months gone with child fasted; after her fast, her husband came to her with a pot of sour milk into which he threw two beans and a grain of barley, and whilst she was drinking it, he asked, "What drinkest thou?" She, having drunk three times, replied, "I drink to the birth of a son." Náráyana, in his Commentary on Asvaláyana, states that the two beans and the grain of barley represent the organs of generation. (*De Gubernatis.*)

At the Yava-chaturthi, on the fourth day of the light half of the month Vaisákh, a sort of game is played in which people throw barley-meal over each other. Yava-sura, an intoxicating drink, is made from barley in Northern India. According to Bretschneider, barley is included among the five cereals, which, it is related in Chinese history, were sowed by the Emperor Shen-nung, who reigned about 2700 B.C.; but it is not one of the five sorts of grain which are used at the ceremony of ploughing and sowing as now annually performed by the emperors of China.

Theophrastus was acquainted with several sorts of barley (κριθή), and, among them, with the six-rowed kind or *hexastichon,* which is the species that is represented on the coins struck at Metapontum in Lucania between the 6th and 2nd centuries B.C.

Barley is mentioned in the Bible as a plant of cultivation in Egypt and Syria, and must have been, among the ancient Hebrews, an important article of food, judging from the quantity allowed by Solomon to the servant of Hiram, king of Tyre (B.C. 1015). The tribute of barley paid to King Jotham by the Ammonites (B.C. 741) is also exactly recorded. The ancients were frequently in the practice of removing the hard integuments of barley by roasting it, and using the torrified grain as food. (*Pharmacographia.*)

The Hindus employ barley in the dietary of the sick. It is chiefly used in the form of *saktu* or powder of the parched grain. Gruel prepared from *saktu* is said to be easily digested and to be useful in painful dyspepsia. In Europe, for use in

medicine and as food for the sick, pearl-barley is always employed; this is the grain deprived of its husk by passing it between horizontal mill-stones, placed so far apart as to rub off the integuments without crushing it. Pearl-barley imported from Europe is obtainable in most Indian bazars. For an account of the economic uses of barley, we would refer the reader to an article by Dr. J. Murray in the *Dict. Econ. Prod. of India* (iv., p. 273).

Description.—The structure of the barley-grain after the paleæ have been removed is similar to that of wheat (see *Triticum*). The paleæ consist chiefly of long fibrous, thick-walled cells, two or four rows deep, constituting a very hard layer. On transverse section, this layer forms a coherent envelope, about 35 mkm. thick; its cells, when examined in longitudinal section, show but a small lumen of peculiar undulated outline from secondary deposits. (*Pharmacographia.*)

Chemical composition.—The following figures representing the average minimum, maximum, and mean composition of 127 samples of barley from different sources are quoted by König:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extract.	Cellulose.	Ash.
Minimum ...	7·23	6·20	1·03	49·11	1·96	·6
Maximum...	20·88	17·46	4·87	72·20	14·16	6·92
Mean ...	13·77	11·14	2·16	64·93	5·31	2·69

According to Church, the average percentage composition of husked Indian barley is, water 12·5, albuminoids 11·5, starch 70·0, oil 1·3, fibre 2·6, ash 2·1.

Lermer (*Vierteljahresschr. für prakt. Pharm.*, XII. (1863), 4-23) found European barley to have the following percentage composition:—Water 13 to 15, oil 3·0, starch 63·0, cellulose 7·0, dextrin 6·6, nitrogen 2·5, ash 2·4, lactic acid a trace. The protein or albuminous matter consists of different principles, chiefly insoluble in cold water. The soluble portion is partly coagulated on boiling, partly retained in solution. 2·5 per cent. of nitrogen, as above, would answer to about 16 per cent of

albuminous matters. Their soluble part seems to be deposited in the starch-cells, next to the gluten cells, which latter contain the insoluble portion.

The ash, according to Lermer, contains 29 per cent. of silicic acid, 32·6 of phosphoric acid, 22·7 of potash, and only 3·7 of lime. In the opinion of Salm-Horstmar, fluorine and lithia are indispensable constituents of barley.

The fixed oil of barley, as proved in 1863 by Hanamann, is a compound of glycerine, with either a mixture of palmitic and lauric acids, or less probably with a peculiar fatty acid. Beckmann's *Hordeinic Acid* obtained in 1855 by distilling barley with sulphuric acid is probably lauric acid. Lintner (1868) has shown barley to contain also a little *Cholesterin*.

Lastly, Kühnemann (1875) extracted from barley a crystallized dextrogyrate sugar, and (1876) an amorphous lævogyrate mucilaginous substance, *Sinistrin*; according to that chemist, dextrin is altogether wanting in barley.

Barley when malted loses 7 per cent.; it then contains 10 to 12 per cent. of sugar, produced at the expense of the starch; before malting no sugar is to be found. (*Pharmacographia.*)

Commerce.—The total yield of barley in British India does not exceed 50,000,000 cwts. In 1887-88 the total exports were 29,575 cwts., valued at Rs. 89,776, of which Bombay shipped 18,688 cwts., Bengal 6,873 cwts., and Sind 4,014 cwts., valued at Rs. 58,632, Rs. 20,556, and Rs. 10,588, respectively. The country which imported most largely was Persia, with 10,358 cwts.; following on which were, Arabia with 7,675 cwts., Ceylon with 7,539 cwts., and Aden, the United Kingdom, Zanzibar, and "other countries" with insignificant quantities. (*Dict. Econ. Prod. India*, iv., p. 281.)

The minor food grains (*Kudhánya* or *Kshudar dhánya*) mentioned by Sanskrit medical writers are:—

Sorghum vulgare, *Pers.*—Yávanála (*Sanskrit*), Joár (*Hind., Beng.*), Javári (*Guz.*), Jondhalá (*Mar.*), Cholum (*Tam.*), Talla (*Tel.*), Chavela (*Mal.*).

This is one of the most important food-crops of India; from it are made bread, porridge, and other food preparations. Church's analysis shows it to have the following percentage composition:—Water 12·5, albuminoids 9·3, starch 72·3, oil 2·0, fibre 2·2, ash 1·7, phosphoric acid 0·85, potash 0·21.

Setaria italica, *Beauv.*—Kangu (*Sanskrit*), Kora (*Hind.*), Kángni (*Beng.*), Káli-kángani (*Mar.*), Bájri (*Guz.*), Tennai (*Tam.*), Korálú (*Tel.*).

The grain is much esteemed as an article of human food in some parts of India. It is eaten in the form of cakes and porridge in the North-West Provinces and Bombay; in Madras it is valued as a material for making pastry, in the Punjab the leaves are used as a pot-herb. Boiled with milk it forms a light and pleasant meal for invalids. Church's analysis shows it to have the following percentage composition:—Water 10·2, albuminoids 10·8, starch 73·4, oil 2·9, fibre 1·5, ash 1·2 (husked).

Panicum miliaceum, *Linn.*—Chína (*Sanskrit*), Chína (*Hind.*), Chína-ghás (*Beng.*), Varagu (*Tam.*), Vorglo (*Tel.*), Varivava (*Mar.*).

This grain is usually made use of in the form of porridge. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 12·6, starch 69·4, oil 3·6, fibre 1·0, ash 1·4 (husked).

Panicum frumentaceum, *Roxb.*—Syámáka (*Sanskrit*), Sawan (*Hind.*), Shyámádhán (*Beng.*), Shamálu (*Tel.*), Kathli, Shamúla (*Mar.*), Savan, Sama (*Guz.*).

This grain is wholesome and nourshing, and is much used for home consumption amongst the poorer classes. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 8·4, starch 72·5, oil 3·0, fibre 2·2, ash 12·9 (unhusked).

Paspalum scrobiculatum, *Linn.*—Kodrava (*Sanskrit*), Koda (*Hind.*), Kodoádhán (*Beng.*), Arugu (*Tel.*), Gora-harik, Gora-kodru (*Mar., Guz.*).

Cases of poisoning are occasionally met with in India, arising from the consumption of this grain as an article of food. The symptoms are similar to those seen in poisoning by darnel (see *Lolium temulentum*). Kodru-poisoning occasionally ends fatally: thus, in a case reported to the Bombay Chemical Analyser, from Godhra, in 1879-80, four persons, *viz.*, a man and three children, were poisoned by eating bread made from the flour, and one of the children died. This grain appears to be only occasionally poisonous; according to popular belief, there are two varieties of the grain, Gora or "sweet," and Májara or "poisonous."

Church's analysis shows the following percentage composition of the husked grain:—Water 11·7, albuminoids 7·0, starch 77·2, oil 2·1, fibre 0·7, ash 1·3.

Hygrorhiza aristata, *Nees.*—Nivára (*Sanskrit*), Uridhán (*Hind.*, *Beng.*), Deobhát (*Mar.*).

See article on Rice. Church's analysis shows that wild rice, after it has been husked, has the following percentage composition:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6.

Eleusine corocana, *Gärtn.*—Rági (*Sanskrit*), Mandua, Mandal (*Hind.*), Marua (*Beng.*), Kayur (*Tam.*), Ponassa (*Tel.*), Rági (*Can.*), Náchni, Nágli (*Mar.*).

This grain is much used by the poorer classes in Western India, usually in the form of porridge. It is considered to be particularly wholesome and digestible, and a thin gruel made from it is much used mixed with cow's milk for weaning children and as a diet for invalids. In Goa thin biscuits are prepared with the flour, from which a gruel can at once be made.

Church's analysis shows the grain to have the following percentage composition:—Water 13·2, albuminoids 7·3, starch 73·2, oil 1·5, fibre 2·5, ash 2·3, phosphoric acid 0·4.

Sorghumsac charatum, *Mœnch.* —Devadhánya (*Sanskrit.*), Deodhán (*Hind.*, *Beng.*), Shálu (*Mar.*), Iniphi (*Guz.*).

A food grain of much value. Church's analysis shows it to have the following percentage composition:—Water 12·8, albuminoids 11·8, starch 68·3, oil 3·0, fibre 3·0, ash 1·1, sugar 6 to 18.

Saccharum sara, *Roxb.*—Cháruka (*Sanskrit*), Sarpa, Sara (*Hind*), Sarabij (*Beng.*), Gundra, Sura (*Tam.*, *Tel.*), Sara (*Mar.*).

The seed of this grass appears to be only used in famine times, or by some of the wild tribes who use the stem for making arrows.

The seeds of Coix and Bambusa, which are also classed amongst the *Kshudra-dhánya*, have been already noticed.

Festuca indica (Rheede, xii., 45) is used to resolve phlegmons.

FILICES.

POLYPODIUM VULGARE, *Linn.*

Fig.—*Eng. Bot.*, 1149; *Woodv. Suppl.*, *t.* 271. Common Polypody (*Eng.*), Polypode de chêne (*Fr.*).

Hab.—Persia, Europe. The rhizomes.

Vernacular.—Basfaij (*Ind. Bazars*).

History, Uses, &c.—This fern is the πολυπόδιον of Theophrastus and Dioscorides, both of whom mention its purgative properties. Dioscorides states that it is used to expel bile and phlegm. Pliny (26, 37) says:—" The root of polypadion, known to us as *filicula*, is used medicinally, being fibrous and of a grass-green colour within, about the thickness of the little finger, and covered with cavernous suckers like those on the arms of the polypus. It is of a sweetish taste, and is found growing among

rocks and under trees. The root is steeped in water, and the juice extracted; sometimes, too, it is cut in small pieces and sprinkled upon cabbage, beet, mallows, or salt meat; or else it is boiled in pap as a gentle aperient for the bowels. It carries off bile and the pituitous humors, but acts injuriously upon the stomach. Dried and powdered and applied to the nostrils, it cauterizes polypus of the nose. It has neither seed nor flower. In Germany there was a myth in ancient times that the plant sprang from the milk of the goddess Freya, and in more recent times the Virgin Mary was credited with its origin. Owing to the sweetness of the rhizome, it is, in some parts of France, called "reglisse" or "liquorice."

The Persians call the plant Tashtiwán and Baspáík; the latter name in the Arabic form of Basfaij is now current throughout the East as the name of the drug, and is used by Ibn Sina and the Arabian physicians. The Arabian names for the plant are, Azrás-el-kalb "dog's tooth," in allusion to the toothed appearance of the leaves, Kathir-el-rijl "many-footed," and Thákib-el-hajar "penetrating stones." The Mahometan physicians use it as an aperient, deobstruent, and alterative combined with myrobalans and fumitory; they consider that it acts as an expeller of all kinds of peccant humors; for instance, we have seen it prescribed in cataract and amaurosis by Indian hakims. It is not an article of the Hindu Materia Medica.

Description.—The dried rhizome occurs in pieces of various lengths, and of the thickness of a quill. It is flattened, of a yellowish-brown colour externally, green internally, but when old yellowish; the upper surface is studded with tubercles, to some of which a portion of the base of the frond still adheres. The under surface is more or less spinous from the remains of broken radicles. The taste is sweetish, astringent, nauseous, and somewhat acrid; odour ferny. Under the microscope, the rhizome is seen to consist of a delicate cellular structure containing much starch and green granular matter; it is traversed by large bundles of scalariform vessels.

POLYPODIUM QUERCIFOLIUM, *Spr.*

Fig.—*Rheede, Hort. Mal. xii., t.* 11. Oak-leaved Polypody (*Eng.*).

Hab.—India. Widely distributed throughout the East. The rhizome.

Vernacular.—Básing, Vándar-básing, Ashva-kátri (*Mar.*).

History, Uses, &c.—Básing (बाशिंग), the Marathi name of this remarkable fern, signifies the crown-like frontlet which the Marathi people tie upon the forehead of the bride and bridegroom at the marriage ceremony. There can be little doubt that the form of the ornament was suggested by the appearance of the plant; its use is of very ancient date, and probably derived from the aboriginal inhabitants of the hilly districts of Western India, where *P. quercifolium* is very abundant. The thick silky rhizome of this fern is found closely adhering to the dead branches of trees, which it envelopes with its large oak-like leaves. Rheede says that the plant is supposed by the natives of Malabar to partake of the properties of whatever tree it grows upon. This notion prevails all over India with regard to this and other parasites (see *Loranthaceæ*), and, as has already been shown, is quite erroneous.

For medicinal purposes those plants which grow upon the *Strychnos Nux-vomica* are preferred. The author of the *Wanaushadi Prakásha* gives the following prescription containing Básing as the best cure for phthisis:—Take 2 tolás of Kájrabásing, 1 tolá Ooksi flowers (*Calycopteris floribunda*), 2 tolás Chiretta, 2 tolás Ghás-pitpapra (*Rostellularia procumbens*), 2 tolás Ringan-múl (root of *Solanum indicum*), 2 tolás Bál-bel-phal (small immature fruit of *Ægle Marmelos*), 2 tolás Padminimúl (root of *Nelumbium speciosum*), 4 tolás Sonar-wel-múl (root of *Vicoa indica*), two tolás Gokhru-múl (root of *Tribulus terrestris*). These nine drugs are to be powdered and divided into seven parts. For administration each part is to be boiled in 40 tolás of water, sweetened with 2 tolás of

sugar-candy, and the decoction (kára) boiled down to one-eighth; this is to be taken in the morning, and the marc is to be again treated in the same manner to furnish the nikára (second decoction) or evening dose. The same prescription is recommended in hectic fever from whatever cause, and in dyspepsia and cough; during its use potatoes and indigestible vegetables are to be avoided.

Rheede (xii., 12, 13) has the following remarks upon the medicinal use of *Polypodium taccifolium* in Malabar:—"Succus radicis vermes enecat, bilem sistit et temperat. Folia in pulverem redacta cum melle assumpta secundinas, menses, imo fœtum ipsum fortiter ejiciunt; mulieres ergo cavete vobis."

ADIANTUM VENUSTUM, *Don.*

Fig.—*Hook. Sp. Fil. ii*, 40; *Bedd. Ferns. Brit. Ind. xx.*

Hab.—Himalaya, Afghanistan, Persia. The plant.

Vernacular.—Hansráj, Mobarkha (*Ind. Bazars*).

History, Uses, &c.—Under the name of ἀδίαντον a fern is described by Dioscorides as having leaves serrated at the top like coriander (φυλλάρια ἔχει κοριάνδρω ὅμοια ἐπεσχισμένα επ ἄκορον). _This plant was doubtless *Adiantum Capillus Veneris*, *tum*, the same description would apply equally well to *A. venus-* but which has been adopted by the Mahometan physicians of the East as representing the ἀδιαντον of the Greeks. The Western Arabs, however, appear to use *A. Capillus Veneris*, as they call the plant Kuzburat-el-bir or "coriander of the well," indicating a habitat where *A. venustum* is not found. Other Arabic names for the genus *Adiantum* are Shaar-el-jinn "fairies' hair," Shaar-el-jibal "hair of the mountains," Shaar-el-fual "hair of omens," Sák-el-aswad "black stem," Nasif-el-aswad "black veil," &c. Ibn Sina and other medical writes describe the drug under the name of Barsiawashán, which is the Arabian form of the Persian name Parsiawashán. It is considered to be deobstruent and resolvent, useful for clearing the *primæ viæ* of bile, adust bile, and phlegmatic humors; also pectoral,

expectorant, diuretic, emmenagogue, and alexipharmic. Used as a plaster it is considered to be discutient, and is applied to chronic tumours of various kinds. The author of the *Burhán* states that the ashes of the plant mixed with olive oil and vinegar are used to make the hair grow upon the bald patches produced by ringworm of the scalp. Theophrastus (*H. P.*, vii., 13) mentions two kinds of *Adiantum*, "white" and "black," used in making hair oil. Greek synonyms for the plant were *politrichon*, *calitrichon*, *trichomanes*, and *ebinotrichon*.

In France a syrup of Maiden-hair is much used as a pectoral; the officinal plant is *A. pedatum*, Linn., or Capillaire du Canada, but *A. trapeziforme*, Linn., Capillaire du Mexique, is allowed as a substitute.

Description.—Fronds 3 to 4 times pinnate. Rachis slender, polished, naked; segments rigid, prominently veined and toothed, upper edge rounded, lower cuneate into the petiole; *sori* one to three, large, roundish, placed in a distinct hollow on the upper edge.

Commerce.—The Maiden-hair of commerce consists solely of *A. venustum*, imported from Persia in large bales which contain a number of small bundles, five or six of which weigh one pound. Value, 3 annas per lb. Other species of *Adiantum* are used locally to a small extent.

ASPLENIUM PARASITICUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii.*, *t.* 17.

Vernacular.—Kári-béli-pánna-maravara (*Mal.*), Mahá-pána (*Mar.*), Káli-pándan (*Goa*).

ASPLENIUM FALCATUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii.*, *t.* 18.

Hab.—India. The rhizomes.

Vernacular.—Nela-pánna-maravara (*Mal.*), Pána (*Mar.*), Pándan (*Goa*).

History, Uses, &c.—The medicinal use of these ferns is due to the Portuguese, who, on their settling in India, adopted them as substitutes for *Asplenium* of Europe.

A fern called ἄσπληνον or ἄσπληνος πόα was supposed by the ancients to have the property of reducing the size of the spleen; it was also known as σκολοπένδριον "centipede plant," from a fancied resemblance of its fronds to that reptile, and ἡμιόνιον "mule plant," because mules were reputed to be fond of feeding upon it. Dioscorides mentions the use of a decoction of the plant in vinegar for enlargement of the spleen, and also the local application of a plaster made of the leaves steeped in wine. It was also considered to be of use in incontinence of urine, calculus, and jaundice. Women were not allowed to use it, as it was supposed to cause sterility. This plant is generally identified with the *Asplenium Ceterach* of Linneus, "Spleen-wort" or "Milt waste"; others have supposed it to be *A. hemionitis*, Linn., "Mules' fern," or *A. Scolopendrium*, Linn., "Hart's tongue."

Mahometan physicians, under the name of Iskúlúkandriún, give a translation of what Dioscorides says concerning this drug, with a few unimportant additions; practically they appear to know nothing about it, and we have never known any drug to be offered under this name in the bazars. Haji Zein states that it is called Hashishat-el-tihál "Spleen-wort" in Arabic, and in Egypt Kaf-el-nasar "Eagle's clan."

The Indian substitute is used in Goa as an alterative in cases of prolonged malarial fever, usually in combination with Oldenlandia or Andrographis, and the use of the drug has spread to Malabar through the Goan Brahmins who have settled there.

Description.—The part used medicinally is the rhizome, to which are attached the bases of the fronds and numerous radicles, all of a black colour. The rhizome is about as thick as the finger; when broken across it is seen to consist of a parenchyma in which are several bundles of vessels of a lighter colour. These can be separated from the canals in which they are situated without much trouble when the rhizome is fresh.

Under the microscope, the cell-walls of the parenchyma appear of a dark-brown colour, and the vascular bundles are seen to consist of large scalariform vessels. It has an astringent and slightly bitter taste.

Actinopteris dichotoma, *Bedd. Vern.*—Mor-pankhi, Mayuraka. A fern which grows in the Nilgiri and Himalaya Mountains, and upon rocks and old walls in the Deccan, but is rare in the plains of India; it is used as a styptic. "*Actinopteris* is a genus of polypodiaceous fern of the section Asplenieæ, and consists of curious little plants like miniature fan palms. The technical peculiarities of the genus among the Asplenieæ consist in the simple distinct indusia, free veins, and linear-elongate sori, which are marginal on the contracted rachiform segments of the small flabelliform fronds." (*T. Moore in "Treasury of Botany."*) Atkinson states that this fern is used as an anthelmintic.

LICHENES.

PARMELIA KAMTSCHADALIS, *Esch.*

Hab.—Himalaya, Persia.

PARMELIA PERLATA, *Esch.*

Fig—*Eng. Bot.*, 341.

Hab.—India, Europe, Africa. The plant.

Vernacular.—Charéla, Charcharéla, Pathar-ke-phúl, Silá-bák (*Hind.*), Motha-dagada-phúl, Bárik-dagada-phúl (*Mar.*), Ghabilo, Chadila (*Guz.*), Kalpasi, Kalapu (*Tam.*), Ratipanché (*Tel.*).

History, Uses, &c.—Two lichens are found in all Indian bazars, which are known as the greater and lesser "stone-flowers" in the vernaculars, and in Sanskrit as Silá-valká or "rock-bark." Similar plants were known to the Greeks as βρύον and σφάγνος, and to the Romans as Muscus. Dioscorides (i., 22) notices their medicinal properties, also Pliny (xii., 61). The Arabs call them Ushnah, a name derived from the

Persian, and Hazáz-el-sakhar "rock-scab." Leith says:—"It is a thing that spreads itself upon the trees called *Balút* and *Sanúbar* (oak and pine) as though it were pared off from a root (كالقشر من عرق); and it is sweet in odour, and white." (*Kámús.*) In Persia these lichens are known as Ushnah and Dowálah. The author of the *Makhzan-el-Adwiya* states that Ushnah grows upon the oak, cypress, and other trees; that which is whitest should be preferred; it should have an agreeable odour. He describes it as astringent, resolvent, and aperient, and says that the decoction is used as a tonic and alterative; when burnt, the smoke relieves headache, the powder is a good cephalic snuff. Externally the drug has emollient and astringent properties, and may be used in a bath or as a poultice, &c. The dry powder is applied to wounds and sores to promote granulation. Honigberger mentions the use of the drug at Lahore in disorders of the stomach, dyspepsia, vomiting, pain in the liver or womb, induration of the uterus, amenorrhœa, calculi, and nocturnal spermatic discharges.

Ainslie (ii., 170) says: "*Kull-pashie* is the Tamool name given to a dried pale-coloured rock moss, which the Vytians suppose to possess a peculiar cooling quality, and prepare with it a liniment for the head."

The use of these lichens in the form of a poultice, placed over the renal and lumbar regions to produce diuresis, is noticed in the *Pharmacopœia of India*.

FUNGI.

MYLITTA LAPIDESCENS, *Horan.*

Fig.—*Trans. Linn. Soc., vol. xxiii., t.* 9, p. 97.

Hab.—India and China.

Vernacular.—Carom-pallagum (*Tam.*), Luy-wan (*China*).

History, Uses, &c.—This curious underground fungus is supposed to be allied to the truffles, and is used in Southern

India as medicine and food. In 1860 Dr. E. J. Waring forwarded to Mr. Hanbury some specimens of these tuberiform productions, and they were examined by Mr. M. J. Berkeley and Mr. Currey. These specimens had been dug out from the chalk-beds in the mountains between Travancore and Tinnevelly, and the hill-people were in the habit of bringing them into Trevandrum for sale. They are much esteemed by native doctors for various complaints, and they are regarded as diuretic. The Tamil name signifies Black Pallagum, Pallagum meaning a medicinal substance. The fungus frequently appears on the Nilgiris, and the Badagas, Karumbars, and other hill-tribes call it "God's bread" or "Little man's bread," and use it for food. In 1889 the Peziza was very plentiful in the Government Cinchona Plantations at Naduvatam, and the specimens were found over a wide area about one foot beneath the surface of the ground. Planters on other parts of the hills have noticed their periodical occurrence in their estates, and the coolies always collect and cook them for their meals.

Description.—These fungoid bodies are like small tubers having a black, finely-wrinkled surface, and the inside is white and marked with veins, and a microscopic section shows the division of the tissue into *areolæ* similar to that exhibited by hypogæous fungi. In a fresh state they have a waxy consistence, but when dry they are hard and horny. Some fresh slices immersed in glycerine for several weeks showed no crystalline or crystalloid formations, and starch was entirely absent.

Chemical composition.—The dried Peziza yielded 1 per cent. of carbonated ash. Boiled with dilute hydrochloric acid a solution was formed, reducing Fehling's test and inactive towards polarised light. Boiled with soda a large quantity of pectinous matter was dissolved.

BOLETUS CROCATUS, *Batsch.*

Hab.—India, on the Jack-tree (*Artocarpus integrifolia*, Linn.).

Vernacular.—Phansámba (*Bazars*), Phanas-alombé (*Mar*).

History, Uses, &c.—The only notice of this fungus, which we have met with, occurs in Rumphius (*Hort. Amb.*, i., 25), where he says:—"In Malabara ac Zeylana ex eodem quoque succo circa radices colligitur et concrescit in terra massa, seu tuber Portugallis *Isca de Jaca* (tinder of the Jack-tree) dictum, quod molle est et intus flavescit, quod natio ista pro experto habet medicamento contra diarrhœam, ad paucas vero tantum colligitur arbores, atque inde venale in alias quoque transfertur regiones." It appears to be probable that the medicinal use of this fungus was introduced into the East by the Portuguese, who adopted it as a substitute for the *Boletus fomentarius* of Linneus, the *Agaricus Chirurgorum* or "surgeon's agaric" of the old European Pharmacopœias, which the Portuguese call Isca de ferir "wound tinder," and the French Agaric de chêne or Polypore ongulé. It is the Spunk or Touchwood of the English.

In Western India the fungus is ground to a paste with water and applied to the gums in cases of excessive salivation. It is also applied to the mouths of children suffering from aphthæ, and is given internally in diarrhœa and dysentery.

Description.—In form this fungus closely resembles the European Boletus above referred to, and resembles the hoof of a horse. Internally it is of a rich orange-brown colour when fresh, and has a sweetish, styptic taste, but when long kept it turns to a dull brown colour. The fungus consists of a number of laminæ upon the under surface of which the hymenium is situated.

Chemical composition.—A proximate analysis yielded :—

Ether extract	·78
Alcoholic extract	1·60
Aqueous extract	4·10
Alkaline extract	21·34
Crude fibre	53·98
Ash	4·30
Moisture	13·90
	100·00

The ether and alcoholic extracts consisted of red-coloured resins, but no fatty matter. The aqueous extract contained 2·42 per cent. of an organic acid not related to tannin in its reaction with ferric chloride and gelatine. Solution of soda removed an acid resin having some of the properties of polyporic acid.

POLYPORUS OFFICINALIS, *Fries.*

Fig.—*Guibourt, Hist. Nat. ii.*, 45; *Pereira, Mat. Med. ii.*, Pt. 1, p. 54. Larch Agaric (*Eng.*), Polypore du Mélèze, Agaric blanc (*Fr.*).

Hab.—Southern Europe, Asia Minor. On the Larch. The fungus.

Vernacular.—Ghárikún (*Indian Bazars*).

History, Uses, &c.—The use of this fungus in medicine is of very ancient date. Dioscorides (iii., 1) describes ἀγαρικόν as male and female, the female being the best and having internally a comb-like structure, whilst the male is convolute, round and compact (συμφυεῖς); both have the same taste, at first sweet, afterwards bitter. He states that it grows in Sarmatia, Galatia in Asia, and Cilicia, and that some suppose it to be a root and others a fungus. It is astringent, hot, and purgative, and is also given in fever, jaundice, nephritis, uterine obstructions, phthisis, dyspepsia, hæmorrhage, and pains in the joints; it is alexipharmic. Pliny (25, 57) says: "Agaric is found growing in the form of a fungus of a white colour, upon the trees in the vicinity of the Bosporus. It is administered in doses of four oboli, beaten up in two cyathi of oxymel. The kind that grows in Galatia is generally looked upon as not so efficacious. The male* agaric is firmer than the other, and more bitter; it is productive, too, of headache. The female plant is of a looser texture; it has a sweet taste at first, which speedily changes into a bitter flavour."

* This distinction into male and female is no longer recognized, though it continued to be so till within the last century. (*Bostock.*)

Pereira states that the drug appears in the modern Greek Pharmacopœia under the name of ἀγαρικόν τὸ λευκον with the Turkish synonym of κατρὰν μανταρι.

Ibn Sina insists upon the great efficacy of agaric (غاريقون) as an alexipharmic. He and other Mahometan physicians closely follow the Greeks in their description of its medicinal properties; they consider that it removes all kinds of visceral obstructions and expels diseased humors; the female kind should be used after it has been rubbed through a hair-sieve and all black particles removed. The use of agaric in phthisis is of ancient date; it was revived by De Haen, Barbut, and others in the present century, and subsequently decried by Andral (*Phil. Trans.*, Vols. 48 and 49). The active principle, agaricin, has recently been recommended in doses of $\frac{1}{12}$ to $\frac{1}{6}$ of a grain as an astringent to check night-sweating and diarrhœa, to diminish bronchial secretion, and to dry up the milk after weaning.

Description.—Pileus corky-fleshy, ungulate, zoned, smooth. Pores yellowish. Berkeley describes the hymenium as concrete with the substance of the pileus, consisting of sub-rotund spores with their simple dissepiments. The drug is decorticated, dried, and bleached, and occurs in white, friable pieces, from the size of the fist to that of a child's head, which are more or less ungulate or of the shape of half a cone, with a feeble fungous odour and bitter acrid taste. The fungus, when met with in its natural state, has an external yellowish or reddish-grey coat.

Chemical composition.—White Agaric has been analysed by Bouillon-La-Grange, by Bucholz, by Braconnot, and by Bley. The constituents, according to Bley, are: resin, 33·1; extractive, 2; gum and bitter extractive, 8·3; vegetable albumen, 0·7; wax, 0·2; fungic acids, 0·13; boletic acid, 0·06; tartaric and phosphoric acids, 1·354; potash, 0·329; lime, 0·16; ammonia and sulphur, traces.

The active principle of Agaric has usually been said to reside in the resin, but a white amorphous bitter powder (laricin) has

been separated from it, the formula of which, according to Will, is $C^{14}H^{12}O^{4}$. Martius considers this to be the active principle. Fleury (*J. Pharm. Chim*, (4) XXI., 279 to 284) gives the following result of an examination of the drug:—Five hundred and eighty grams of the powdered fungus, not previously dried, were exhausted successively with ether, alcohol, cold water, boiling water, water acidulated with hydrochloric acid, and water rendered alkaline with potash, and the resulting solutions were examined:—

1. The ether extracts a resin, and a body to which the name of Agaric acid is given. The examination of several salts of this acid yielded results so discordant that no definite formula could be obtained, but the nearest approaches to accuracy lead to the supposition that its formula may be $C^{24}H^{44}O^{7}$. Efforts made to determine the basicity of the acid were unsuccessful. It is shown that the addition of the elements of water to the resin represents the composition of the agaric acid. After heating with very dilute sulphuric acid, a substance is yielded which reduces the cupro-potassic liquor. The agaric acid amounts to about one-fifth of the weight of the fungus.

2. The alcoholic solution has a very red colour, due apparently to the air, and on evaporation yields a residue of the consistence of hard wax, from which ether dissolves a resinous body soluble in alkaline liquids; its reaction is acid, it is not crystallizable, and it contains 1·5 per cent. of nitrogen. It combines with metallic oxides. The remainder behaves like a resin; it is reddish, nitrogenized, fusible below 100°, forms viscous solutions with alkalies, and gelatinous precipitates with other bases.

3. Cold water yields a red solution, which on concentration deposits calcic and possibly also magnesic oxalate in microscopic crystals, while the solution contains a brown resinous nitrogenous body, considered to be identical with Boudier's viscosin.

4. Boiling water extracts a small quantity of a nitrogenous substance.

5. Water acidulated with hydrochloric acid (2 per cent.) yields a yellowish solution containing lime, iron, magnesia, and oxalic, phosphoric and malic acids.

6. Water containing 2 per cent. of potash yielded a solution, which, on treatment with hydrochloric acid, deposited a flocculent substance unacted upon by acetic or phosphoric acids, and containing 3·12 per cent. of nitrogen.

The remainder, after this treatment, is a whitish flocculent substance; on drying at 100° it blackens and coheres, yet its microscope appearance does not differ from the original aspect of the fungus. It contains 1·21 per cent. of nitrogen, and affords on calcination 2 per cent. of ash containing lime, iron, magnesia (chiefly), potash, and sulphuric and phosphoric acids. The body possesses all the properties of fungin.

The following is the tabulated result of the analysis:—

Water	9·200
1. Resin and agaric acid	60·584
2 Another resin with magnesia sulphate ...	7·282
3. Resinous body with lime and magnesia ...	2·514
4. Nitrogenous substance with salts	1·900
5. Oxalate, malate, and phosphate of calcium, iron, &c.	1·058
6. Nitrogenous substance soluble in potash ...	7·776
Fungin	9·686
	100·000

Schmieder has found that this fungus contains from 4 to 6 per cent. of a fat which is not a glyceride. He obtained from it a crystalline substance having a composition represented by the formula $C^{10}H^{16}O$, which he terms "agaricol." The liquid portion of the fat yields no glycerine on saponification, but cetyl-alcohol and another alcohol together with two hydrocarbons, while the fat acid with which the alcohols are naturally combined appears to resemble ricinic acid (*Rep. of "Naturforscher and Aerzte" Meeting at Berlin*, 1886).

ALGÆ.

GELIDIUM CARTILAGINEUM, *Gaill.*
GELIDIUM CORNEUM, *Lam.*

Vernacular.—Chini-ghás (*Ind. Bazars*).

History, Uses, &c.—This substance, called Yang-tsai by the Chinese, and known in Europe as Mousse de Chine, Agar-agar, Thao, or Japanese Isinglass, is prepared from the two species of Gelidium placed at the head of this article, and also probably from *Sphærococcus compressus*, Ag., and *Gloiopeltis tenax*, I. Ag. Hanbury (*Pharm. Journ.* (II.), Vol. I., p. 508) gives the following account of it:—"Under the incorrect name of *Japanese isinglass*, there has been lately imported into London from Japan, a quantity of a substance having the form of compressed, irregularly four-sided sticks, apparently composed of shrivelled, semi-transparent, yellowish-white membrane; they are eleven inches long by from 1 to 1½ inches broad, full of cavities, very light (each weighing about 3 drachms), rather flexible but easily broken, and devoid of taste and smell. Treated with cold water, a stick increases greatly in volume, becoming a quadrangular, spongy bar, with somewhat concave sides 1½ inches wide. Though not soluble in cold water to any important extent, the substance dissolves for the most part when boiled for some time, and the solution, even though dilute, gelatinizes upon cooling. The substance under notice is used by Europeans in China as a substitute for true isinglass, for which many of its properties render it highly efficient. That which is perhaps most distinctive is its power of combining with a very large proportion of water to form a jelly. This property is due to the principle named by M. Payen *Gélose*, of which the Japanese sea-weed product mainly consists. The jelly formed by boiling this sea-weed product or crude Gélose in water, and allowing the solution to cool, requires a high temperature for fusion, differing in this respect

from a jelly made of isinglass, which readily fuses and dissolves in warm water.

This substance has attracted considerable attention in France. It was exhibited at the Paris Exhibition of 1878 under the name of Thao. The following particulars from the Catalogue may prove interesting. Various trials have been made with it in France since 1874, especially by MM. D. Gantillon & Co. at Lyons, and the Industrial Society at Rouen. The thao is prepared for use in the following way:—After having been soaked in cold water for about twelve hours, it is boiled for a quarter of an hour, during which it absorbs about 100 times its weight of water. If allowed to cool it becomes a jelly, but if passed through a sieve and stirred until cold, it remains fluid, and in this state is more easily employed than when hot. The yellowish matter which some specimens contain can be removed by boiling for some time, when it forms an insoluble scum, which appears to consist of very thin fibres, and which remain attached to the sides of the vessel.

A singular property, and one which perhaps might be turned to valuable account, is, that thao jelly does not decompose solution of permanganate of potash even when left in contact with it for twenty-four hours.

According to M. Heilmann, of Rouen, thao produces, in the proportion of 1 part to 100 of water, a dressing, which is supple and strong, and which gives substance rather than stiffness to calico, while dextrine, like starch, makes the tissue drier and harder, and gives less facing to the thread. The addition of glycerine gives a dressing still more flexible and soft, and, while rendering the tissues less stiff, it communicates more body to them.

The addition of talc gives still greater smoothness. Once dissolved, according to M. Gantillon, thao will mix while hot with any gum, starch, dextrine or gelatine. The principal advantage of thao in dressing silk fabrics is that while preserving their suppleness it gives them greater glossiness and makes

them soft to the touch. The mixture of thao with gum tragacanth is said to be the best method of using it. Thao should, however, be used alone for materials which it is not necessary should be stiffened. As thao is only soluble at a high temperature, a moist atmosphere, fog, or even rain does not affect the material dressed with it.

It combines well with sulphate of copper and the chlorides of aniline and potassium, and can be used in double dyeing.

It also answers well for sizing paper, &c. The only obstacle to its extensive use is its high price. There is, however, no reason why a similar substance should not be made from our common native sea-weeds, of which *Gelideum corneum* and *Gracilaria confervoides* approach omst nearly in character the algæ from which thao is made. Gélose, of which thao consists, differs from the Carrageenin obtained from *Chondrus crispus* in its power of combining with a very large quantity of water to form a jelly; it yields ten times as much jelly as an equal weight of isinglass. For purposes of food, thao jelly is not quite so pleasant as animal jelly, as it does not melt in the mouth; it also contains no nitrogen. A great advantage which it possesses is, that it is but little prone to undergo change, so much so that the jelly is sometimes imported from Singapore, under the name of *sea-weed jelly*, sweetened, flavoured, and ready for use, and may in this state be kept for years without deterioration. Of late it has been much used for the purpose of Bacteria culture, especially in warm climates.

Chemical composition.—According to Payen, Gélose in a pure state constitutes an immediate peculiar principle, insoluble in alkaline solutions of soda, potash, and ammonia, as well as in water, alcohol, ether, and dilute acids. One of its distinctive characters, which is quite peculiar, is that of dissolving slowly in a very small quantity of concentrated sulphuric or hydrochloric acid, which it colours brown, forming with one or other of them a brown compound, which gradually solidifies, and which resists washing in cold or hot water, and even in caustic

alkaline solutions. This new immediate principle cannot be confounded with any other. The ultimate analysis of Gélose presents the following results:—Carbon 42·77, Hydrogen 5·775, Oxygen 51·445. As it has not yet been possible to form with it any definite combination, from which its equivalent weight or rational formula could be deduced, it must for the present be ranked among the immediate principles having oxygen exceeding the proportion necessary to form water with the hydrogen they contain. Gélose differs from animal gelatine in not precipitating tannic acid; from starch jelly, in not being rendered blue by iodine; from gum, by its insolubility in cold water, and its great gelatinising power. From the mucilage of *Chondrus crispus*, named by Pereira Carrageenin, it appears to differ chiefly in its power of combining with a great amount of water to form a jelly, which is not the case with Carrageenin.

GRACILARIA LICHENOIDES, *Grev.*

Fig —*Bentl. and Trim., t.* 306. Ceylon Moss (*Eng.*).

Hab.—Backwaters of Ceylon. The plant.

Vernacular.—Chini-ghás (*Ind. Bazars*), Agar-agar (*Ceylon*).

History, Uses, &c.—Ceylon Moss or Agar-agar has long been used in Southern India and Ceylon as a nutritive, emolient, demulcent and alterative, especially valuable in pectoral affections. It has been described by Rumphius, Gmelin, Turner, Neos, Agardh, and O'Shaughnessy. (Conf. *Pereira's Mat. Med.*, Vol. II., Pt. I., p. 13.) It grows abundantly in the large lake or backwater which extends between Putlam and Calpentyr, and is collected by the natives principally during the south-west monsoon, when it becomes separated by the agitation of the water. The moss is spread on mats and dried in the sun for two or three days, it is then washed several times in fresh water, and again exposed to the sun, which bleaches it. The following directions for using the moss are given in

the *Bengal Pharmacopœia*, p. 276:—For a decoction, take 2 drachms ground to fine powder, water 1 quart, boil for 20 minutes and strain through muslin. By increasing the proportion of the ground moss to half an ounce, the filtered solution on cooling becomes a firm jelly, which, when flavoured by cinnamon or lemon peel, sugar and a little wine, is an excellent article of light food for sick children and convalescents.

Description.—Ceylon Moss is in whitish or yellowish-white ramifying filaments of several inches in length (when unbleached it is purple). At the base the largest fibres do not exceed in thickness a crowquill; the smallest fibres are about as thick as fine sewing thread. To the naked eye the filaments appear almost cylindrical and filiform; but when examined by a microscope, they appear shrivelled and wrinkled. The branchings are sometimes dichotomous, at other times irregular. The coccidia are inconspicuous when dry, but when moist are readily seen. They are hemispherical, about the size of a poppy seed, and contain a mass of minute oblong, dark-red spores. The consistence of Ceylon moss is cartilaginous. Its flavour that of sea-weed, with a feebly saline taste. (*Pereira's Mat. Med.*, Vol. II., Pt. I., p. 14.)

Microscopic structure.—Frond composed of large oblong cylindrical cells, containing granular endochrome, those of the surface forming moniliform, densely packed filaments. Fructification of two kinds—1*st*, hemispherical coccidia, containing a glomerule of oblong spores on a central placenta, within a pericarp of moniliform densely crowded filaments; 2*nd*, oblong tetraspores imbedded in cells of the surface. (*Endlicher.*)

Chemical composition.—This algal has been examined chemically, in 1834, by O'Shaughnessy; in 1842, by Guibourt; and in 1843, by Wonneberg and Kreysiig, by Bley and by Riegel. O'Shaughnessy found it to consist in 100 parts of vegetable jelly 54·5, starch 15·0, ligneous fibre (cellulose?) 18·0, mucilage 4·0, inorganic salts 7·5.

König gives the following as representing the percentage composition:—

Water	19·56
Albuminoids	2·53
Nitrogen-free extract	73·60
Ash	4·31

The authors of the *Pharmacographia* state that, "Cold water removes the mucilage, which after due concentration may be precipitated by neutral acetate of lead. This mucilage, when boiled for some time with nitric acid, produces oxalic acid and microscopic crystals of mucic acid, beautifully seen by polarised light, soluble in boiling water and precipitating on cooling. With one part of the drug and 100 parts of boiling water, a thick liquid is obtained, which affords transparent precipitates with neutral acetate of lead or alcohol, in the same way as Carrageen. With 50 parts of water, a transparent tasteless jelly, devoid of viscosity, is produced; in common with the mucilage it furnishes mucic acid if treated with nitric acid. Micro-chemical tests do not manifest albuminous matter in this plant. Some chemists have regarded the jelly extracted by boiling water as identical with pectin, but the fact requires proof. Payen called it Gélose." (See last Article.) Mr. H. G. Greenish has examined the carbohydrates of Ceylon Moss, and found that the gelatinizing constituent—the Gélose of Payen—is a carbohydrate convertible by boiling with dilute acid into Arabinose, and probably indentical with a similar constituent in the Agar-agar. In addition to this body (36·7 per cent.), the drug contains mucilage, starch, metarabin, wood gum, and cellulose. A carbohydrate termed Paramylan, occurring to the extent of 6·5 per cent., is also present. This substance is dissolved out by dilute acid, and differs from Pararabin in being directly convertible into sugar, and then yielding not Arabinose, but a fermentable sugar, probably grape-sugar. (*Archiv. der Pharmacie,* xvii, 241.) The inorganic salts of Ceylon Moss consist, according to O'Shaughnessy, of sulphates, phosphates and chlorides of sodium and calcium, with neither iodide nor bromide. Bley found iron, silica and iodic salt in the ash.

Commerce.—See last Article. This substance is preferred to Japanese Isinglass by the Hindus, as they suspect the latter substance to be of animal origin. Value, Rs. 12 per cwt.

LAMINARIA SACCHARINA, *Lam.*

Fig.—*Turn. Fuc.*, *t.* 163. Sweet Tangle (*Eng.*).

Hab.—All deep Seas. The plant.

Vernacular.—Galhár-ka-patta (*Hind.*).

History, Uses, &c.—This sea-weed is a regular article of commerce coming through Cashmere to India, and is to be found in most of the bazars of the Punjab and Sind. Cayley (1867) noted its import into Leh from Yarkand, and Honigberger states that in his time the plant was officinal at Lahore and in Cashmere, and that it was stated to be obtained from a salt lake somewhere in Tibet. Murray says that it is supposed to come from the Caspian, and that it is used in Sind in the form of a syrup combined with a decoction of quince seeds for the cure of goitre, scrofula, and syphilitic affections. When dried in the sun it exudes a whitish saccharine substance.

For an interesting note on *Algin,* first isolated by Mr. Stanford from sea-weed, we would refer the reader to the *Jr. Soc. Chem. Industry* for 1885 and 1886.

DIATOMACEÆ.

Husn-i-yusuf is composed of small, hard, white bodies, which, on being magnified, are seen to be the shells of different diatoms. The drug is described in native medical works as very acrid and only to be used externally as a rubefacient. It is said to be found floating in lakes in Cashmere, and would appear to be the same as the Shuka of Sanskrit medical

writers, which was rubbed in to increase venereal excitement; its use seems to have been much abused, as we find *Shukadoshanimittavyadhayah* (sores caused by Shuka) treated of as a disease by Susruta.

The Madhukosha describes Shuka thus—

शूको जलशूकः । यस्तु विषजंतुर्जलमण्डूकः स शूकः । शूकप्रधानो वात्स्यायनायुक्तो योगो लिंगवृद्धिकरः स शूक उच्यते । सटीकनिदानम् ।

—*Calcutta Ed.*, p. 298.

END OF THE THIRD VOLUME.

PHARMACOGRAPHIA INDICA.

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5-7256

AND

APPENDIX

TO THE

PHARMACOGRAPHIA INDICA,

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C. J. H. WARDEN.
DAVID HOOPER.

July, 1893.

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APPENDIX.

RANUNCULACEÆ.

On the Crystalline Alkaloid of Aconitum Napellus.*

Messrs. Wyndham R. Dunstan and W. H. Ince, Ph.D., have investigated the properties of a crystalline alkaloid obtained from the root of *Aconitum Napellus* by extraction with amyl alcohol, as suggested by the late Mr. John Williams (*Pharm. Journ.* [3], xviii., 238). For a supply of the material they are indebted to the kindness of Messrs. Howards & Sons, of Stratford.

The yellowish indistinct crystals melted at 188·4° (corr.), and by crystallization from alcoholic solution were proved to be associated with a small quantity of a gummy amorphous base. On combustion the original substance gave numbers agreeing fairly well with the formula $C^{33}H^{43}NO^{12}$, which is that proposed for aconitine by Wright and Luff (*Journ. Chem. Soc.*, 1879). The alkaloid was purified by repeated crystallization from a mixture of alcohol and ether, or more readily by conversion into its hydrobromide and regeneration of the alkaloid from this salt or by regeneration from its crystalline aurochloride. It crystallizes in tabular prisms belonging to the rhombic system; the crystallography of the substance has formed the subject of a separate inquiry by Mr. Tutton. The crystals are very slightly soluble in water and light petroleum, more soluble in ether and alcohol, most soluble in benzene and chloroform. They melt at 188·5° (corr.). Contrary to the statements of previous observers, who found aconitine to be lævo-rotatory, the authors found an alcoholic solution to be *dextro-rotatory* $[\alpha]_D +$ 10·78°; the aqueous solution of the hydrobromide is, however, lævo-rotatory $[\alpha]_D$—30·47°. On analysis, the pure alkaloid afforded results which agreed best with the formula $C^{33}H^{45}NO^{12}$.

Two crystalline *aurochlorides* were obtained. One ($C^{33}H^{45}NO^{12}$ $HAuCl^4$), melts at 135·5° (corr.); the other, a basic aurochloride ($C^{33}H^{45}NO^{12}AuCl^3$), melts at 129° (corr.). These compounds are obtained without difficulty, and afford trustworthy means of

* The substance of a communication made to the Chemical Society, March 19, 1891.

identifying aconitine. The alkaloid may be readily recovered from them in a pure state.

Aconitine is not appreciably affected by heating at a temperature below its melting point, but at this temperature it is gradually converted into the uncrystallizable base aconine. Prolonged boiling in aqueous solution induces a similar change, but not to the same extent, unless an alkali is present. Boiling with water acidulated with hydrochloric acid also produces decomposition of the alkaloid.

Dehydraconitine or *apoaconitine* is a base differing from aconitine by the absence of a molecular proportion of water, which was first obtained by Wright and Luff by acting on aconitine with acids. Its existence has, however, been questioned by later workers. The authors find that such a substance may be readily procured by heating aconitine with saturated aqueous tartaric acid in closed tubes, as recommended by Wright and Luff. The crystals of this substance melt at 186·5° (corr.). It forms crystalline salts, and in other respects closely resembles the parent alkaloid. The results of analyses agree well with the formula $C^{33}H^{43}NO^{11}$. Three *aurochlorides* were obtained. One ($C^{33}H^{43}NO^{11}HAuCl^{4}$) melts at 141° (corr.). This salt, when crystallized from aqueous alcohol, becomes a hydrate—

$$(C^{33}H^{43}NO^{11}HAuCl^{4}H^{2}O),$$

melting at 129° (corr.), isomeric with aconitine aurochloride, into which, indeed, it very readily changes. The third aurochloride is a direct compound of the alkaloid with auric chloride ($C^{33}H^{43}NO^{11}$ $AuCl^{3}$); it melts at 147·5° (corr.).

An *amorphous base* was obtained from aconitine, together with benzoic acid, by prolonged heating with water in a closed tube. It appears to be identical with the *aconine* of Wright and Luff. The same substance is formed together with a resinous substance when aconitine is heated with an alkali. Neither aconine nor its salts could be crystallized. The amorphous base, after purification, and its amorphous aurochloride, afforded analytical data agreeing respectively with the formulæ $C^{26}H^{41}NO^{11}$ and $C^{26}H^{41}NO^{11}HAuCl^{4}$.

The Alkaloids of True Aconitum Napellus.

Professor Dunstan and Mr. John C. Umney have examined the alkaloids of true *Aconitum Napellus* plants grown by Mr. E. M. Holmes, at the instance of the British Pharmaceutical Conference.

The alkaloids were extracted from the root by the following process, which precludes the possibility of the occurrence of hydrolysis, &c.:— The solution obtained by percolating with cold rectified fusel oil (b. p. 100–132°) was agitated with water acidified with 1 per cent. of sulphuric acid, and the resin having been removed by extracting the acid solution so obtained with chloroform, the liquid was made just alkaline with dilute ammonia and extracted with ether, which dissolved out a considerable quantity of alkaloid, but left in solution a further and smaller quantity, which was subsequently extracted by agitation with chloroform. The *alkaloid soluble in ether* was obtained as a gum-like mass incapable of crystallization. By conversion into bromhydride it was separated into a crystallizable and an uncrystallizable salt.

The crystalline product was identified as the salt of aconitine, the crystalline and highly toxic alkaloid already described by one of the authors and Dr. W. H. Ince (*C. S. Trans.*, 1891). The alkaloid separated from the pure bromhydride melted at 188·5° (corr.), and afforded on combustion numbers agreeing with the formula $C^{33}H^{45}NO^{12}$. The specific rotation of the bromhydride in aqueous solution was ascertained to be $[\alpha]_D$—29·65, a value which agrees with that previously recorded. As some doubt exists as to the solubility of aconitine in water, a determination was carefully made with this pure specimen. The mean of two determinations gave 1 gram in 4,431 grams of water as the solubility at 22°; Jürgens had previously recorded the far greater solubility of 1 in 745 at the same temperature.

The non-crystalline bromhydride furnished a gummy alkaloid soluble in ether and alcohol, but only sparingly soluble in water, the aqueous solution being alkaline to litmus, and very bitter, but not giving rise to the tingling sensation so characteristic of aconitine. Not only the alkaloid, but also the chlorhydride, sulphate, nitrate and aurichloride prepared from it could not be crystallized. This alkaloid is not identical either with aconine or with the picraconitine of Wright and Luff. A full account of it will be given in a later paper, considerable progress having already been made in the most difficult task of isolating it in a pure state. The authors propose to assign to it the name *napelline*, which was first given to the alkaloid now known as pseudaconitine, and afterwards by Hübschmann to a substance which the work of Wright and Luff showed to be a mixture chiefly composed of aconine. The napelline obtained in the manner described

is probably associated with another amorphous alkaloid about which they have at present little information to give beyond the fact that neither it nor its salts appear to crystallize.

The *alkaloid soluble in chloroform* was proved to be *aconine*, the compound which is obtained together with benzoic acid on hydrolysing aconitine.

The roots of true *Aconitum Napellus*, therefore, must be held to contain three alkaloids, one of which is crystalline, *viz.*, aconitine, two being amorphous, *viz.*, napelline and aconine. Indications have been obtained of the presence of a fourth alkaloid, which is amorphous and closely resembles napelline.

The authors find that the juice expressed from the roots contains a large proportion of amorphous bases but very little aconitine, the greater part of this latter remaining in the root, from which it may be extracted, together with the remainder of the amorphous alkaloids, by exhausting with amyl alcohol. The total quantity of amorphous alkaloid obtained amounted to more than twice that of aconitine.

The physiological action of the alkaloids referred to is being investigated. The results so far obtained point to the conclusion that crystalline aconitine is by far the most toxic of the alkaloids contained in *Aconitum Napellus*.

The formation and properties of Aconine and its conversion into Aconitine.

Owing to the uncertainty which exists with reference to the product of the hydrolysis of aconitine, Professor W. R. Dunstan and Dr. F. W. Passmore have re-investigated the subject, using a pure alkaloid. Wright and Luff have stated that when aconitine is hydrolysed, the sole products are aconine and benzoic acid. More recently, however, Dragendorff and Jürgens have asserted that the hydrolysis occurs in two stages, their contention being that benzoic acid and an alkaloid identical with the picraconitine isolated by Wright and Luff from the roots of supposed *Aconitum Napellus* are formed in the first stage, while in the second stage the picraconitine is hydrolysed into benzoic acid, methyl alcohol, and aconine, which last is the final product of hydrolysis.

The authors have carefully hydrolysed pure aconitine by heating it with water in closed tubes at 150°, but have been unable to obtain at any stage either picraconitine or methyl alcohol. The alkaloid

extracted from the solution by ether was proved to be a mixture of aconine with unaltered aconitine. Using pure aconitine, action occurs precisely in accordance with the equation $C^{33}H^{45}NO^{12} + H^2O = C^{26}H^{41}NO^{11} + C^7H^6O^2$, leaving little doubt that aconitine is benzoyl-aconine.

Although attempts to establish the correctness of this inference by heating aconine with benzoic anhydride were without result, anhydro-aconitine was eventually obtained by the interaction of aconine and ethylic benzoate at 130°: as the anhydro-compound is convertible into aconitine, the partial synthesis of the alkaloid thus effected leaves no doubt that it is benzoylaconine.

Up to the present time, neither aconine nor its salts have been obtained in a crystalline state. The authors have hitherto been unsuccessful in all their attempts to crystallise aconine, but they have succeeded in crystallising several of its salts, *viz*, the chlor-hydride, bromhydride, sulphate, and nitrate. All these salts are very soluble in water, the chlorhydride being least soluble and the easiest to crystallise: it is best prepared by crystallisation from a mixture of alcohol and ether; when dried at 100° it melts at 175·5° (corr.). The crystals deposited from alcohol have the composition $C^{26}H^{41}NO^{11},HCl,2H^2O$. When dried at 100° they still retain one molecular proportion of water, which is, however, lost at 120°. The aqueous solution is lævo-rotatory: $[\alpha]_D = -7·71°$. It combines with auric chloride, forming an aurichloride considerably more soluble than the corresponding aconitine salt.

Aconine was prepared from the pure chlorhydride by adding silver sulphate and subsequent treatment of the aconine sulphate with exactly sufficient baryta water. The solution on evaporation furnished a hygroscopic, brittle gum which refused to crystallise; this melted at 132° (corr.), and on analysis it afforded numbers agreeing with the formula $C^{26}H^{41}NO^{11}$, which is that proposed by Dunstan and Ince from the results of their study of pure aconitine. Aconine is very soluble in water; the aqueous solution is alkaline. When dry it is insoluble in ether and almost insoluble in chloroform. It is a powerful reducing agent, precipitating the metals from solutions of gold and silver salts; it also reduces Fehling's solution. The physiological action of pure aconine is being investigated. Its aqueous solution is slightly bitter and gives rise to a burning sensation in the mouth, but does not produce the tingling which is

characteristic of aconitine. In respect of its action on polarised light, aconine exhibits the same peculiarity as aconitine. Its salts are lævo-rotatory, whilst a solution of the alkaloid is dextro-rotatory, $[\alpha]_D + 23°$. When heated with alkalis, aconine slowly resinifies.

The action of various re-agents on aconine has so far not led to any important results. Nitrous acid fails to attack it. The principal product of its oxidation by alkaline permanganate is oxalic acid. Attempts to isolate an additive compound with methyl iodide have been unsuccessful.

By the action of methyl iodide on aconitine a crystalline *aconitine methiodide* ($C^{33}H^{45}NO^{12} \cdot CH^3I$) was obtained, which melts at 219° (corr.). The *aconitine methhydroxide* prepared from the compound ($C^{33}H^{45}NO^{12} \cdot CH^3OH$) is amorphous, and the salts which it yields do not appear to crystallise. A further study will be made of this compound, and its physiological action will be investigated.

Professor Dunstan, in conjunction with Messrs. Harrison and Carr, has continued his investigation of the aconite alkaloids, and the results were communicated to the Chemical Society, February 2, 1893. It was discovered that aconite root contains an amorphous alkaloid, napelline, which is isomeric with aconitine, but has a distinctly different physiological effect, and is not nearly so poisonous. In an examination of some commercial specimens of aconitine, the authors found large proportions of amorphous alkaloids present, and specimens of aconitine salts were found, in nearly every case, to be chiefly napelline salts containing small quantities of aconitine compounds.

The Aconites and Aconitines.

E. Richards and F. A. Rogers arrive at the following conclusions :—

The best material for the preparation of aconitine is the fresh root of *Aconitum Napellus.*

The alkaloid resides chiefly in the cambium layer, the fibro-vascular bundles, and the sieve ducts.

Pure aconitine crystallizes in thin, flat, hexagonal prisms with acute ends.

It is probable that two isomeric forms of aconitine exist; for these the terms α-aconitine and β-aconitine are suggested.

The composition of aconitine corresponds to the formula $C^{33}H^{43}N^{2}O^{12}$, which contains twice as much nitrogen as the formula hitherto accepted.

The proportion of alkaloid in the root is as follows :—

		Per cent.
Aconitum Napellus, fresh	... ...	0·71
„ „ dried	... ...	0·14
Japanese aconite „	... ...	0·57

The method for the preparation of aconitine, recommended by the authors, is as follows :—

The powdered tubers are macerated from three to four days with washed fusel oil, then percolated, and the alkaloid extracted from the percolate with small quantities of dilute sulphuric acid. The fusel oil is removed from this solution by treatment with ether, and the dissolved ether driven off by heat. The alkaloid is precipitated from the acid solution by solution of sodium carbonate, collected on a strainer, pressed between limestones, and then spread on bibulous paper and allowed to dry at ordinary temperature. The dried alkaloid is then boiled with pure dry ether, and the filtrate set aside to crystallize; the crystals are redissolved in a small quantity of ether to remove a gum-like body.

The toxicity of α-aconitine is stated to be only one-sixth of that of β-aconitine. (*Chemist and Druggist*, Feb. 7, 1891, 205, and Feb. 15, 1891, 242, 243.)

Ehrenberg and Purfürst infer from their experiments with aconitine that its composition is more correctly represented by the formula $C^{33}H^{43}NO^{11}$, than by that assigned to it by Wright and Luff ($C^{33}H^{43}NO^{12}$), or Dunstan and Ince ($C^{33}H^{45}NO^{12}$). They state that by heating with water to 150° C., or by treatment with alcoholic potash, aconitine does not at once yield benzoic acid and aconine; but that, in addition to benzoic acid, methylic alcohol and another acid are produced. The authors state that by boiling aconitine with water there is at first produced a salt of a new base, which crystallizes when the liquid cools, and this product is described by them as benzoate of picraconitine. This is represented as being formed by simple hydrolysis—

$$C^{33}H^{43}NO^{11}+H^{2}O=C^{26}H^{39}NO^{10}+C^{7}H^{6}O^{2}.$$

By continuing the boiling a further alteration is effected according to the equation—

$$C^{25}H^{3}NO^{10} + H^{2}O = C^{24}H^{37}NO^{10} + CH^{3}OH.$$

Picraconitine. Napelline. Methyl alcohol.

The formation of aconine is represented as constituting a third stage of alteration as follows :—

$$C^{24}H^{37}NO^{10} + H^{2}O = C^{22}H^{35}NO^{9} + C^{2}O^{4}H^{2}.$$

Napelline. Aconine. Acetic acid.

The authors suggest that it is still doubtful whether the acid product of this final change is acetic acid or acrylic acid, and that, in the latter case, the formula of aconine would be $C^{21}H^{35} + NO^{9}$.

From the production of mehtyl alcohol in the decomposition of aconitine when heated with water, it is inferred that aconitine is analogous to cocaine, and is to be classed with the acid esters, either as an acetyl or an acryl ester of benzoyl aconine, while aconine itself would be a derivative of a trimethoxylmethyl quinone. (*Journ. f. prakt. Chem.*, xlv., 604.)

Note on Mishmee Teeta and Bee (or Poison).

These roots are procured on the range of hills inhabited by the Mishmee tribe, and annually in the cold season a large supply is brought down to the plains, and the Mahajans here, who are principally Marwar people, give in exchange for them beads, salt, coloured woollen and cotton cloths, &c., &c. The Mahajans state that these articles are readily purchased in Central and Lower Assam.

The Natives here use the Teeta as a medicine in colic, ophthalmia, headache, and fever.

The *Bee* or poison, which is brought down by the hill-tribes, is parboiled with a view to prevent its cultivation in the plains. It is generally employed by hunters for killing wild animals.

Mishmee Teeta as a remedy for Colic.—Take 20 grains of Mishmee Teeta, 10 to 12 whole grains of black pepper, about 10 grains of salt. The whole is to be masticated and washed down with a small quantity of water.

Mishmee Teeta as a remedy for Ophthalmia and Headache.—Take 2 drachms of Mishmee Teeta and grind it with sufficient water to form a paste, which is to be applied round the eye twice a day. For headache it is applied to the forehead and temples.

Mishmee Teeta as a remedy in Fever.—Take 1 drachm Mishmee Teeta finely powdered, and mix with half a pint of cold water. To be taken daily in two doses. Purgatives are never used by the hill-tribes.

Mishmee Bee (or poison) employed by hunters.—Take 2 or 3 drachms of Mishmee Bee finely ground, and mix with any acid glutinous vegetable pulp, so as to form a thick paste, which is to be applied to the head of the arrow and allowed to dry in the shade.

The glutinous substance generally used is the pulp of a sour fruit called *Owe Tangah* by the Assamese and *Chultah* in Bengali (*Dillenia Speciosa*). I imagine it is preferred in consequence of its acidity preventing a flow of blood from the wound, which would wash away the poison. (*By the Medical Officer, Chyckwah, Upper Assam, June 11th*, 1842.)

Delphinium Zalil.

Aitchison (*Notes on Products of W. Afghanistan and N.-E. Persia*, p. 55) says :—"Yellow Larkspur, *asbarg, aswarg, isbarg, isbarag, isparak, sparak, sparig, jalil, zalil*; the flowers, *gul-i-zalil, gul-i-jalil.* A perennial herb, with a thick short woody rootstock, from which several annual shoots spring ; these are from one to two feet in height, each usually bearing a terminal spike of exquisite yellow flowers. When the flowers are at their best, the annual shoots bearing the spike of inflorescence is broken off close to the root; these are collected together, and then laid in heaps, usually on the roofs of the houses, to dry. In two or three days they are sufficiently dry, when the twigs are shaken over a sheet ; on this all the flowers tumble off, and are collected, either for local use or exportation. The petals are of commercial importance, yielding a valuable yellow dye for silk, and are exported for this purpose in large quantities to Persia, Turkistan, Afghanistan, and India. The dye is easily obtained by simply boiling the flowers in water ; in this decoction the silk is dipped. The dried stems also yield a dye upon being boiled, but this is poor in comparison with that yielded by the flowers."

In the *Dict. Econ. Prod. of India*, iii., 70, it is stated that in Multan the flowers are used along with *Akalbér* (*Datisca cannabina*) and alum to dye silk, giving a sulphur-yellow colour known as *gandhaki*, and that they are also used in calico-printing. Their price in the Punjab is said to be Rs. 27·5 per cwt. This dye is alluded to by Mr. Leotard, Dr. McCann, and Mr. Wardle, but under the name of *D. Ajacis*.

The Hellebores of the Ancients.*

Drugs prepared from hellebore were so famous amongst the ancients as a remedy for madness, and, indeed, for many other ailments, that the plant has acquired for itself a literary as well as a botanical interest. Pliny gives a list of them quite worth the notice of advertisers of patent medicines. We know that different species have been used in different countries for their medicinal properties, which are, perhaps, essentially the same in all of them, though varying in strength. The hellebore of the modern English Pharmacopœia is the root of *Helleborus niger*, the common Christmas Rose. In Germany, *H. viridis*, the green hellebore, is said to be preferred, and from its frequent occurrence in England in the neighbourhood of old ruins, we may infer that it was formerly used here. At Constantinople a popular drug, called Zoptane, is made from *H. orientalis*, which is common on the mountains of Eastern Turkey. In Gerard's time, our native *H. fœtidus*, the rankest of all the genus, was employed medicinally, though known to require great caution in using, and it is still retained in veterinary practice for outward application.

The physicians of ancient Greece, who for some centuries before and after the Christian era were famous throughout the civilized world for their skill, were very fanciful about the locality from which the herbs used by them were collected. The kind of herb might be the same, but when gathered on a particular mountain or in a particular forest it was thought to have additional virtue. Drugs of the same name were classified as first, second, third or fourth quality, according to the source from which they came, and were priced and trusted accordingly. Hellebore was of two kinds, distinguished as black and white. The best black came from Mount Helicon, and the best white from Mount Œta. The town most famous for its preparation was called Anticyra, but this name was ambiguous.

* From the *Gardeners' Chronicle*, January 2.

There is a well-known passage in "The Art of Poetry," written by the Roman poet Horace, in which he says, that to gain a reputation as a poet, a man must be so mad that three Anticyras cannot cure him, and must never have his hair cut. Multiplying by three was a common superlative figure of speech in Latin, as in any other languages, and perhaps Horace meant no more than this; but, on the other hand, he may have known that there were in Greece three towns named Anticyra, and possibly they were all places where the drug hellebore was prepared. One Anticyra was on a narrow strip of the land of the Locrians, between Ætolia and the sea. Strabo, an ancient writer on geography, and Livy, a Roman historian, both mention it. It was taken by the Romans in the second Punic war, and given over to their allies, the Ætolians. We know nothing of it as connected with hellebore, though Phiny tells us that Ætolian hellebore, which was of bad quality, was used to adulterate the better Parnassian kind. There was another Anticyra in the south-eastern corner of Thessaly, three or four miles from the sea, near the base of Mount Œta and the famous pass of Thermopylæ, but we do not hear of this town as producing hellebore, except on the slight authority of the lexicographer, Stephanus of Byzantium, who lived in the sixth century of our era. The third Anticyra, the only one which we know to have been famous in classical times for the manufacture of this drug, was situated on the southern coast of Phocis, not far from the base of Mount Parnassus, and within a few miles of Mount Helicon. The position of it is well known, and it is now named Aspra Spitia; it was not an island, as Pliny and others have wrongly said, and never can have been so in historic times; but it stood on a peninsula and had a good harbour. In Horace's day it was a place of resort for insane or epileptic patients, who went there to take a course of hellebore under resident physicians. Hence, to say, "You should go to Anticyra," was a polite way of telling a man he was a fool. Amongst others who had gone through this medical course there, Pliny mentions the philosopher Carneades, who went there for intellectual training, before publicly declaiming against the dogmas of the Stoics, apparently supposing that a medicine which could make madmen sane would make sane men still wiser. Also Drusus, a famous popular leader of the Romans, was cured there of epilepsy. The same writer adds that this drug, which retained its

virtue for thirty years, and once was thought so formidable, had now become so "promiscuous" in its use that students often took a dose of it to sharpen their intellect when they were puzzled by difficult passages in their reading—a valuable hint, by the way, for candidates before a competitive examination! I recollect a virtuous freshman at Cambridge, who, with a similar object, laid in a large stock of "Reading biscuits," which he saw advertised in a window!

The next question is, what were the kinds of hellebore called black and white, and found respectively on Mount Helicon and Mount Œta? We ought to be able to answer this, because Edmond Boissier has told us, in the preface to *Flora Orientalis*, that, thanks to the labours of the botanists, Orphanides and Heldreich, the flora of Greece is now better known than that of any other country within the scope of his work. The hellebore which is found to prevail on Mount Helicon, Mount Parnassus, and the neighbouring country is one to which E. Boissier gives the name of *H. cyclophyllus*. It is intermediate between *H. viridis* and *H. orientalis*, having been confused with the latter both by Sibthorp and by Heldreich. Perhaps it is not in cultivation in England, but it is described as being taller and having larger flowers and broader segments to the leaves than the green hellebore, which in other characters it resembles.

As for the white hellebore, it is evident from the vague descriptions of Theophrastus and Pliny, that neither of them knew a living hellebore by sight, but Pliny says that he had been told that the leaf of the black hellebore was of the shape of a plane leaf, but divided into several segments, and that the white hellebore had leaves resembling those of the beet, and deeply channelled at the back. He attributes to it a bulbous root like that of an onion, with fibrous tunics. Ancient and modern botanists have generally identified this with *Veratrum album*, which is figured in Gerard's "Herbal" as the white hellebore; but perhaps the best evidence is that of Heldreich, who explored Mount Œta in 1879, and found *V. album* growing there in abundance, confirming his previous opinion that this was the white hellebore of Theophrastus. The different effects of the two kinds of hellebore taken medicinally, as recorded by ancient authorities, correspond with modern experience; the black is a powerful cathartic, and the white a strong emetic. This is a summary of all that is known or likely ever to be known of the famous hellebores of the ancients. (*C. Wolley-Dod, Pharm. Journ.*, Jan. 30, 1892.)

We have never met with any kind of hellebore root in the Indian Bazars, nor are any of the genus known to grow in India; still, all Indian Mahometan works on Materia Medica contain an account of the hellebores of the Greeks, which has been copied from the writings of the Arabian physicians, and which is mostly a reproduction of what Dioscorides says περὶ ἐλλεβόρου λευκου and περὶ ἐλλεβόρου μέλανος the *Verarum album et nigrum* of the Romans. The Arabs call these drugs *Kharbak-abiad* and *Kharbak aswad*, and in Indian medical works *Kutki* or *Kutaki* is given the vernacular equivalent of Kharbak, and this drug is sold as a substitute for it. For an account of Kutaki, see Vol. III., p. 10.

MAGNOLIACEÆ.

Constituents of Star-anise.

The determinations of volatile oil, fixed oil, and ash gave the following percentage figures:—

	Volatile Oil.	Fixed Oil.	Ash.
Carpels	6·11	1·13	2·81
	5·20	1·47	
Seeds	3·00	22·9	2·46
	2·40	21·7	

The volatile oil consists chiefly of anethol $C^6H^4(OCH^3)C^3H^5$; with small quantities of terpenes, safrol $C^6H^3(O^2CH^2)C^3H^5$, the monoethyl ether of hydroquinone $C^6H^4(OH)OC^2H^5$, anisic acid $C^6H^4(OCH^3)COOH$, and a complex aromatic substance yielding upon oxidation veratric acid and piperonal. The fixed oil contains the usual constituents along with cholesterin and derivatives of phosphoric acid. In the aqueous extract is found protocatechuic acid and shikiminic acid $C^7H^{10}O^5$, which by nascent hydrogen iodide is converted into benzoic acid. Sugar was not found in any appreciable quantity, the sweet taste of the fruit, therefore, depending upon the volatile oil. Nitrogenous bases could not be detected. (*F. Ostwald, Arch. der Pharm.*, 1891, 84—115.)

Michelia Champaca.

Merck describes a kind of camphor, called champacol, obtained from champaca wood by distillation with water. After purification it melts at 86—88°C., has the form of long white felted needles, has no odour when pure, but when kept in an impure state becomes liquid and develops the agreeable odour of the wood. (*Berichte*, 1892, p. 18.)

MENISPERMACEÆ.

Constituents of Calumba Root.

M. Bocchiola (*Chemist and Druggist*, Jan. 10, 1891) **gives the** following percentage composition of the cortical and **woody portions** of the root:—

	Outer part.	Inner part.
Water	13·00	14·00
Ash	5·00	6·00
Ether extract	0·70	0·80
Alcohol extract	3·89	3·86
Proof Spirit extract	17·96	17·80
Calumbine	1·42	1·90
Do. . by titration	0·98	1·38
Berberine	1·43	0·72
Do. by titration	2·95	1·45

The percentage composition of the ash was:—

Silicic acid 14·13 and 7·42, phosphoric acid, as an iron salt, 6·11 and 1·61, phosphoric acid, combined with alkali and earthy bases, 5·04 and 12·63, in the outer and inner parts of the root.

The author found old roots to contain as much as 2·07 and 2·63 per cent. of calumbine, and 2·05 and 1·02 per cent. of berberine, showing their superiority over the younger roots.

BERBERIDEÆ.

Berberis vulgaris, *Linn.*

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 25) has the following notice of this plant:—"The Barberry, *jir*, *jir-khár*, *zer-khár*, *zir*, *zir-bár*, *zir-balak*; the fruit, *zirishk*, *sirishk*. A very common shrub, growing at an altitude of 2,000 feet and upwards, from which is largely collected the fruit; this is consumed locally, as well as being exported in some quantity to India, where it is highly appreciated by the natives as a condiment. Usually the fruit contains no seeds; it is then much more oval, longer, and of a much lighter colour than that which has seeds. On reaching the Punjab the fruit or preserve is called *zirishk-tursh*, to distinguish it in the trade from small, dried, black grapes; the latter are our European currants, or corinths. From the root-stocks of the

BERBERIS is obtained an extract called *Ibrán*; this is a yellow dye, which is also employed in medicine as a local application to inflamed eyes."

Podophyllum emodi.

We have met with the root in the plains in the possession of a pilgrim from Kedernath. He called it *Mámirán*, and greatly valued it as a remedy for ophthalmia, his small stock of four or five roots was carefully wrapped in several covers of silk.

Analysis of the Resin of Podophyllum emodi.

Ash	None.
Moisture	4·2
Oily and waxy matter, soluble in benzin	4·0
Podophyllotoxic acid	13·1
Podophyllotoxin, active principle	56·55
Inert matter insoluble in chloroform and soluble in alcohol	22·15
	100·0

The percentage of active principle, podophyllotoxin, in this sample is fully 25 per cent. higher than the average amount found in resin of podophyllum, which varies from 40 to 45 per cent. American podophyllum yields, on a large manufacturing scale, 5 per cent. of podophyllin, and accepting 10 per cent. as a practical average from the Indian, we should have a drug worth 2½ times in value. (*By F. A. Thompson, Ph. G., Am. Journ. Pharm.*, May, 1890.)

Podophyllotoxin.

This substance, which was first shown to be the active principle of Podophyllin by Podwissotzki, has now been obtained in a pure state by Neuberger (*Arch. f. exp. Path. u. Pharm.*, xxviii., H. 1, 1890); it forms colourless prismatic crystals, little soluble in water, but freely soluble in alcohol, forming an intensely bitter solution. Frogs were not easily affected by it, and it required a dose of 0·01 gram administered in mucilage to produce a muscular rigidity which was followed by death in three days; a congested state of the intestinal vessels was observed in some cases. It appeared to have little or no

action upon rabbits. Cats were very susceptible to the poison, death following three days after the subcutaneous injection of 0·001 gram. In these animals, 2 to 3 hours after the injection violent and repeated vomitings occurred, at first of food, and afterwards of mucus tinged with bile, and containing some intestinal worms; there was also obstinate diarrhœa. Finally the animals became dull, the temperature fell, the limbs were paralysed, and death occurred from exhaustion. Dogs, pigeons, and fowls were similarly affected.

The *post-mortem* appearances observed were intense irritation, and sometimes abscess at the seat of the injection, the stomach normal or slightly injected, the upper portion of the mucous membrane of the duodenum highly injected, especially round the opening of biliary duct, the lower portion covered by a mass of brown epithelium mixed with detritus and mucus; the lower part of the small intestine, and the whole of the large intestine, was covered by hæmorrhagic patches, and here and there by a membranous exudation, with intense inflammation of the adenoid tissue, the sub-mucous and muscular layers not being affected. Liver congested, gall-bladder swollen and full of bile. Kidneys congested, with marked glomerulo-nephritis and commencing tubular nephritis. The distended gall-bladder and injection of the duct appearing to indicate elimination of the drug through the liver, the author tied the latter in three of the dogs experimented upon, and afterwards injected podophyllotoxin beneath the skin; the results were exactly the same as in the case of the dogs not previously so treated.

Injections of podophyllotoxin into the veins gave exactly the same results as when it was administered internally or injected subcutaneously. The circulation, respiration, and nervous system were only affected a little before the fatal termination in all the animals experimented upon.

From these experiments the author concludes that the drug acts as a simple irritant, and that its purgative action when given internally is due to irritation of the intestinal canal. When injected under the skin or into a vein, it is eliminated by the blood through the kidneys and intestine, and in its passage through these organs it sets up the irritative action already described.

Mr. J. C. Umney contributed a paper on *Podophyllum emodi* at the Pharmaceutical Conference held in Edinburgh in August 1892, from which we extract the following :—

The results of Podwissotzki's work on the resin of *P. peltatum* may be briefly summarized thus—

The physiologically active portion of podophyllum resin consists of podophyllotoxin, which is composed of picropodophyllin held in solution by picropodophyllic acid.

Picropodophyllin is a neutral crystalline principle, which, though the sole active ingredient of the resin, is inactive in its free state, owing to its insolubility, but in combination with, or more probably solution in, picropodophyllic acid is extremely active. The resin also contains an inactive acid—podophyllic acid, a yellow colouring matter,—podophylloquercetin and fatty matter.

The results of the examination of *P. emodi* resin are classified in the following table, and are compared with the analysis, under the same conditions, of a sample of resin of *P. peltatum* :—

	P. emodi.	*P. peltatum.*
Resin by official process for podophyllin resin	11·4	5·9
Constituents of the resin—		
Podophyllotoxin (crude)	17·8	33·8
Pure crystalline picropodophyllin	2·6	4·5
Picropodophyllic acid	not determined.	not determined.
Podophyllic acid	30·8	6·9
Podophylloquercetin	1·3	2·4
Fatty matter	2·3	5·7

The picropodophyllin melted at 208—210°C.

The podophyllic acid melted at 125°.

The podophylloquercetin melted at 248°.

Mr. Umney concludes his paper by saying that the rhizome of *Podophyllum emodi* yields nearly double the amount of resin yielded by *P. peltatum*, but the resin contained only about half the quantity of crystalline picropodophyllin, to which the value as a cathartic is due.

We have not heard of any medical opinions concerning the value of the resin, and without such opinion founded on physiological experiments we cannot decide the question of making this drug an official source of podophyllin resin.

PAPAVERACEÆ.

The Opium Assay Question.

Perhaps no chapter of Pharmaceutical Chemistry has received more attention and been more discussed than that of opium and its analysis. Scarcely a journal appears nowadays that does not contain an article or two upon how opium can "best" be assayed and just how the method of Prof. X—— or Mr. Y—— is inaccurate and unreliable. There is a certain sameness about articles written about opium assaying—a sameness that becomes monotonous in course of time, and causes the reader to become perplexed, if not disgusted, as the result of a perusal of them. Invariably the author picks all other methods to pieces and then proposes an "original new" method which gives better agreeing results, and is much more easily manipulated than any yet proposed. As a matter of fact, we possess not a single accurate and exact method of analysis of any plant or of any of its organic constituents. Plant analysis, as Dragendorff aptly remarks, has not yet reached the stage which enables us to say, without an interrogation point at the end of our sentence, that this plant contains just so much of that constituent and no more. Plant analysis is as yet synonymous with approximate analysis, and until our knowledge of the chemistry and physiology of plant life and growth has advanced considerably beyond its present status, it is doomed to continue to be approximate analysis. Hence, no method is accurate, as, for instance, is the determination of sulphuric acid as barium sulphate, or of hydrochloric acid as chloride of silver, and if one of them does give better agreeing results, and such as are nearer the mean of those obtained by all other methods, this is due most probably to the fact that in this particular method the sources of error are more nearly counterbalanced than in the others. It was, hence, from a purely impartial and critical standpoint that I undertook to compare several of the most prominent methods for assaying opium.

Those decided upon were the methods of Flückiger, Squibb, and of the U. S. Pharmacopœia—being virtually the ammonia *versus* the lime method. The drugs examined were Smyrna opiums from the house of Merck and of Gehe & Co., the former having been ordered and received by myself while still at the laboratory of Geh. Rath Fresenius at Wiesbaden during the past summer, and the

latter kindly given me by my instructor, Professor Flückiger, here at the laboratory. Both samples were finely powdered and dried at 80° C. for five hours. All three methods were begun at the same time, and the directions for each closely followed throughout. In both cases the determination by the U. S. P. method was completed long ere the others were, while Squibb's method, due to its more frequent washing and slower filtering, took up the most time. Just at this point I should like to protest against the impracticability and uselessness of weighing liquids, which so often is found in methods of plant analysis and nowhere else. As I see the matter, there is not one point in its favor, unless, perhaps, that it is an inherited custom, while there are certainly many points against it. Firstly—it occupies more time; secondly—accurate balances are not arranged for weighing liquids, and inaccurate balances (or moderately accurate balances, as their owners would probably prefer to term them) certainly make the weighing less accurate than measuring; and thirdly—weighing, even on accurate balances, is seldom, if ever, more accurate than measuring with graduated glassware, which every druggist does, or, at any rate, should possess. The U. S. P. method, besides being the shorter, required less attention and care than the other methods, and, as the figures will shew, gave the most satisfactory results. As this is all that is required of a method of analysis, I can see no reason why the present officinal process should be altered, for no other now in use is more exact and at the same time as practical. The morphine obtained in every experiment with the U. S. P. method was undoubtedly the whitest and purest of all the crystals obtained by any method. There was less washing necessary than in either Squibb's or Flückiger's method, and at the same time the filters and crystals upon them were beyond any question of a doubt the purest and whitest. Here follow the figures:—

	Merck Opium.	Gehe Opium.
Flückiger	9·52 p. c.	13·95 p. c.
Squibb	11·67 p. c.	16·52 p. c.
U. S. P.	11·44 p. c.	15·00 p. c.

As these figures shew, Flückiger's method gave the lowest and Squibb's the highest results, which facts are, however, very easily explained, and as follows: In Flückiger's method the result depends very much, if not entirely, upon the amount of shaking that is done,

as Dieterich has conclusively shewn, and as I only shook for about half an hour steadily, with continued shaking at intervals of ten minutes for two hours more, it is very probable that all of the morphine did not separate out. The high figures obtained by Squibb's method are undoubtedly to be explained by the impurity of the resulting products, which fact could readily be detected by the naked eye, as they were invariably very dark-coloured. Despite all the washing that they were subjected to, they never once were even approximately near being colourless, and besides invariably dissolved in lime water only in part and gave as a result a very dark-coloured solution. It was found that continued washing would not remove the impurities, for long before the crystals and filter paper shewed any signs of becoming decolourized, the wash water ran through absolutely pure and colourless. In both cases the morphine obtained by the U. S. P. method dissolved completely in lime water and gave a pure, limpid, clear solution, while that obtained by Flückiger's method, although it gave a colourless solution in lime water, yet left a small residue amounting to several milligrams and consisting of narcotine, as did the residue obtained in Squibb's method. This would indicate that in the presence of alcohol and water, the ether does not completely dissolve all of the narcotine.

Morphine Picrate.

Inasmuch as this salt of morphine had not yet been described, and the similar salt of strychnine is practically insoluble in water, and hence enable us to determine the alkaloid as strychnine picrate, it was made by treating a solution of morphine hydrochlorate with a slight excess of picric acid, in the hope that it, too, might prove to be insoluble, and thus facilitate somewhat the method of determining morphine. Recrystallized from alcohol it crystallizes in groups of fine yellow needles arranged most peculiarly in the shape of warts, which grow one along-side of the other, and hang from the surface of the liquid looking much like plaits of hair. The salt melts, or, better, decomposes, without detonation at 157° *C*. It differs from the corresponding salt of strychnine, however, in not being insoluble in either water or alcohol, as determinations of its solubility gave the following results:—

In distilled water at 13° *C.*—15·6975 grams of a saturated solution yielded 0·031 grams of morphine picrate (dried at 100°) which gives a solubility of 1 part in 500 parts of water.

In absolute alcohol at 13° *C.*—7·2422 grams of a saturated solution yielded 0·009 grams of morphine picrate (dried at 100°) which gives a solubility of 1 part in 800 parts of alcohol.

This being the case, it is, of course, impossible to make use of the salt as a means of determining morphine. (*Alfred Dohme, Ph.D., Laboratory of Prof. Flückiger, University of Strassburg*, February 17, 1891; *Am. Jour. Pharm.*, April, 1891.)

The Chemistry of Opium.

At the instigation of my esteemed instructor, Prof. Flückiger, I undertook to study the phenomena which present themselves when opium is dialyzed. When the investigation was first begun, the prime object in view was to determine, if possible, to what cause the acid reaction of aqueous extract of opium was due, and how morphine was combined in the drug. As the work progressed, it was decided to study the relative quantities of the chief constituents of the drug, and, if possible, then draw conclusions in regard to how these are combined in nature in the same. In how far this has proven successful the conclusions will shew; suffice it to say here that the work was a very long-drawn out and laborious one, and not one of the results obtained with the ease which one is accustomed to in inorganic analysis. As is the case in every operation with drugs and plants of any kind, the numerous colouring matters, gums, resins, and the many other amorphous substances of which we have but little definite knowledge, save that they exist to worry the chemist, very much hindered the work in many respects. Dialysis was chosen, inasmuch as by means of it it was hoped that all of the looked-for constituents would pass into solution, while little or none of the undesired would follow suit. Besides this, no operation was to be performed with the opium which might change the nature of combination of its various constituents. It had been observed by Flückiger that there is, in all probability, enough sulphuric acid present in opium to combine with nearly all of the alkaloids present. Whether or not, however, it is sulpuric acid or meconic acid that is in excess and hence free, as yet remained an open question. It is certainly very probable that if it were a question of which acid would first and most readily be neutralized by the bases, that sulphuric acid would be the one, although mass action might cause some of the meconic acid to be in combination at the expense of

sulphuric acid. With this aim in view, 50 grams of finely powdered opium were rubbed together with distilled water and the paste washed completely into a dialyser consisting of an oval gutta-percha ring covered with heavy parchment paper and immersed in a dish containing about five litres of distilled water. This was allowed to stand covered thus for nearly three months, the water being changed about twice a week. Even at the expiration of this time, sulphuric acid and alkaloids could be detected in the dialysate, and as my time here was limited, and the semester was rapidly drawing to a close, it was decided to finish the operation more expeditiously by exhausting the opium remaining in the dialyser with cold water. This last extract was treated separately, although exactly in the same way as the greater portion. While this operation was quietly progressing, a complete analysis of the ash of opium (the same as was used for dialysis) was made in order thus to get a definite idea of the mineral constituents of the drug. Accordingly, 20 grams of finely powdered opium were carefully and gradually ignited in portions in a platinum dish. It was found very difficult to completely incinerate the drug, so that even after heating the dish to a bright red heat the resulting ash was quite dark, in fact nearly black. It was found very advantageous at this point to treat the mass with a little cold water and evaporate this off on a water-bath, and finally, again carefully heat and glow it over a free flame. By repeating this operation several times, an ash was obtained, which was very nearly pure white in colour. When weighed, it yielded 3·89 per cent. of the original substance.

A complete analysis, the details of which it would be useless to enumerate here, gave the following results, these being expressed in per cent. of the ash weighed:—

	Per cent.
SiO^2	11·14
P^2O^5	8·07
SO^3	28·39
Fe^2O^3	1·98
CaO	9·04
MgO	8·31
K^2O	30·19
CO^2,HCl and undetermined constituents	2·88
	100·00

The dialysate was next evaporated down in portions to about two litres upon a water-bath, and the resulting deposit, consisting of colouring and other organic matter, as well as some calcium meconate, removed by filtration. The filtrate reacted acid to litmus, and in it were detected morphine, narcotine, narceine, codeine, sulphuric, and meconic acids. It was next acidified with hydrochloric acid, and after heating on the water-bath was treated with a boiling solution of barium chloride in excess. After standing over night the resulting barium sulphate was filtered off and washed out with hot water containing hydrochloric acid until it was white. It was then dried, ignited, and weighed, and yielded, with the portion that was similarly treated separately, the following figures :—

Portion I—$BaSO^4$	2·9236 grams.
Portion II— ,, ...	0·3920 ,,
Total...	= 3·3156

Equivalent to $\left\{ \begin{array}{l} 1{\cdot}3945 \text{ grams } H^2SO^4, \\ \text{or } 1{\cdot}1384 \text{ ,, } SO^3 \end{array} \right\}$

The filtrate from this precipitate was neutralized and precipitated in the cold with ammonia which was added in slight excess. After standing for several days, the precipitated alkaloids were filtered off and the filtrate again made ammoniacal and left to stand, when more alkaloid was precipitated. This was continued until the resulting filtrate no longer gave a reaction for alkaloids. The various precipitates were then filtered off and dried at 80° C. to constant weight, and regarded as the total alkaloids of the opium taken. They were then treated for several days with an excess of lime-water until this took up no more alkaloid. The remaining alkaloids were then filtered off, washed with slightly ammoniacal cold water, and dried at 80° C. They were then weighed and regarded as narcotine. The results obtained are given below—

Porcelain dish + alkaloids (total)	= 24·3023 gr.
,, ,, alone	= 14·0465 gr.
Hence, total alkaloids found	= 10·2558 gr.
Narcotine (weighed on tared filter)	= 4·3631

giving as the final result—

Morphine, 5·8927 grams, equivalent to 11·79 per cent.
Narcotine, 4·3631 ,, ,, to 8·73 ,, ,,

The other alkaloids present in opium, such as codeine, narceine, papaverine, &c., were not considered separately, as they, in all probability, play the same *rôle* with respect to the acids present as does morphine.

In a separate experiment with the same opium, which was dialysed in the same manner as that just described, the dialysate was shaken with amyl alcohol, the latter then separated and shaken in a separating funnel with a solution of sodium hydroxide for half an hour, and the alkaline layer separated as before. This was then acidified, and a few drops of it, when brought in contact with a drop of a solution of ferric chloride, gave a beautiful wine-red colour, thus shewing the presence of meconic acid. Inasmuch as experiments with morphine and narcotine meconates had shewn that neither of these are taken up by amyl alcohol, it follows that the free acid in the dialysate was meconic acid.

Conclusions.

(i) That the free acid in aqueous opium extracts is meconic acid;

(ii) That the silica in opium is present in the form of sand, and that the lime is most likely combined with phosphoric acid, while the magnesia and potash are probably combined with organic acids and some sulphuric acid;

(iii) That there is more than enough sulphuric acid present in opium to combine with all of the alkaloids present save narcotine; for the 5·8927 grams of morphine, narceine, codeine, &c., found, require only 1·0133 grams of sulphuric acid to form the salts $(C^{17}H^{19}NO^{3})^{2}\ H^{2}SO^{4}$, &c., whereas there were found in all 1·3945 grams of sulphuric acid; and

(iv) That hence, morphine, narceine, codeine, &c., are contained in opium combined with sulphuric acid as sulphates, while narcotine, at best only a feeble base, is combined in part, at least, with meconic acid, of which there is also some present uncombined in the drug.

In conclusion, I should like to take this occasion to thank Prof. Flückiger for the kind assistance and advice I obtained from him while working in his laboratory, and also Mr. J. E. Gerock, his excellent and kind assistant. (*A. Dohme, Am. Jour. Pharm.*, April, 1891.)

Protopine.

The name of *protopine* was given to a particular alkaloid first isolated from opium in 1870 by Hesse. It is only present to a small amount in the dried milky juice of the *Papaver somniferum*. Since its discovery by Hesse, it has been met with again by Eykmann in the *Macleya cordata*, and by Selle in the juice of the

Chelidonium majus : all of these plants belong to the same family of *Papaveraceæ*. In connection with this subject we read in a recent number of the *Therapeutic Gazette* that Dr. Engel has lately made some experiments on cold-blooded animals (frogs) and warm-blooded animals (guinea-pigs, cats, and rabbits), with the view of determining the physiological properties of this new base protopine. The results obtained may be briefly summarised as follows:—(1) In small doses protopine exercises on the frog narcotic effects similar to those produced by other opium alkaloids. (2) In large doses it produces a paralysing action on the muscular substance, and on the terminal ramifications of the peripheral nerves. (3) With small or moderate doses reflex action is not abolished, although this occurs when larger doses are given. (4) Protopine produces toxic effects in mammals, and these effects are comparable to those produced by camphor, death resulting from the paralysis of the respiratory centre. This last conclusion is very interesting. It is singular that camphor, which has not the chemical constitution of the alkaloids, and belongs to an entirely different group of bodies, should have been found to produce the same toxic effects as are obtained with new base protopine. The knowledge of this fact will cause camphor to be prescribed with more care than formerly, and it will probably lead to more useful applications of it, and to its employment in a number of cases for which it is not yet used. Protopine has not yet been introduced into therapeutics, and from the above experiments it is evident we must know more about it before it can find its place in pharmacy.

Tritopine—a new Opium Base.

M. Kander (*Archiv.*, ccxxviii., p. 419) reports the isolation of a new opium alkaloid, *Tritopine*, which occurs in smaller quantity than even protopine, and to which he assigns the formula $C^{42}H^{54}N^2O^7$. Like morphine and laudanine it is soluble in soda solution, but is reprecipitated in an oily condition by excess of the reagent. Its melting point, 182° C., is, however, 16° higher than that of laudanine, although the resemblance is again apparent in its behaviour towards sulphuric acid. Tritopine crystallizes without water of crystallization in characteristic transparent needle-like plates, and appears to be a di-acid base. (*Pharm. Journ.* [3], xxi., 247.)

Indian Opium.

In regard to opium, it has recently been suggested that India might be made the source of supply in place of Turkey. In a paper read at the Conference Meeting at Cardiff, Mr. E. M. Holmes expressed the opinion that there is no reason why India, instead of Turkey, should not supply the whole world with medicinal opium. This assumption appears to be rather premature and scarcely to be warranted by such knowledge as we possess of Indian opium. There seem to be several questions to be solved before the substitution of Indian for Turkey opium can be looked upon as feasible.

In the first place, it is necessary to ascertain whether opium can be produced in India of a quality equal to that of Turkey opium. Dr. Warden's statement that native opium is used for medicinal purposes in India does not sufficiently settle that point, but as he has sent over a sample of the Patna opium issued by the Medical Store Department of Bengal for medicinal use, we have examined it with a view to ascertaining the amount of morphine it contains and its applicability for pharmaceutical purposes.

The sample sent by Dr. Warden was in the state of powder, and as received it contained 3·2 per cent. of moisture. In the dried opium the amount of morphine was found to be 8·55 per cent.

A tincture was made with the dried opium, according to the directions of the British Pharmacopœia, and on examination it was found to yield on evaporation to dryness a residue of extract amounting to 21·3 grains per fluid ounce. The amount of morphine contained in the tincture was 2·74 grains per fluid ounce.

For the sake of comparison, another tincture was prepared with a good sample of Turkey opium that was found to contain, in the dry state, 10·84 per cent. of morphine. The extract yielded by this tincture on evaporation amounted to 19·8 grains per fluid ounce. The amount of morphine in it was 3·4 grains per fluid ounce.

It may be pointed out that in both the abovementioned instances the extraction of morphine from the opium in making the tinctures by the method of the British Pharmacopœia was practically complete, as will be seen from the following comparison of the quantities of morphine actually found by experiment:—

	Found. Grs. per fld. oz.	Calculated. Grs. per fld. oz.
Indian opium tincture	2·74	2·80
Turkey " "	3·40	3·55

Both these tinctures were of the ordinary character, and there was scarcely any perceptible difference in their appearance. (Dr. B. H. Paul and A. J. Cownley in *Pharm Journ.*, December 24th, 1892, p. 505.) For further information on the employment of Indian opium for medicinal purposes, the reader is referred to some correspondence in the *Pharm. Journ.* for 1892 by Messrs. Holmes and Warden.

FUMARIACEÆ.

Fumarine.

According to Herr Reichwald (*Pharm. Zeit. f. Russl.*, March and April, 1889), fumarine has a composition represented by the formula $C^{21}H^{19}NO^4$, and can be obtained in colourless crystals, freely soluble in chloroform, less soluble in benzol, still less soluble in alcohol and ether, and sparingly soluble in water. When placed upon the tongue, fumarine is tasteless, but a solution in acidulated water has a bitter taste. It is inactive towards polarized light. On the other hand, crystalline corydaline, prepared from *Corydalis cava*, has a composition represented by the formula $C^{22}H^{19}NO^2$. Among other points of difference between the two alkaloids, fumarine is described as giving with concentrated sulphuric acid immediately an intense violet colour, whilst corydaline remains colourless for several hours, and then only becomes pale violet. Corydaline treated with strong nitric acid takes at once an intense golden-yellow colour, whilst fumarine is only faintly yellow; becoming darker after a time. The yield of fumarine was only equal to 0·04 per cent. of the dried herb used. (*Pharm. Journ.*, June 8th, 1889.)

Fumaria parviflora, *Lamk.*

Under the name of *Shahtereh*, we have received this plant from Afghanistan.

CRUCIFERÆ.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 194) records the collection of the seeds of *Sisymbrium Sophia*, Linn., for medicinal use under the name of *Khakshi* or *Khakshir.*

Lepidium sativum.

Mohideen Sheriff has used these seeds with success in dysentery and dysenteric diarrhœa. The seeds are small, red or reddish-brown; elliptical, oval or oblong; about one line in length and half of that

in thickness; taste mucilaginous and slightly pungent when chewed and swallowed, and their smell is slight, peculiar, and not unpleasant. When immersed in water, the seeds become coated with mucilage.

CAPPARIDEÆ.

Mærua arenaria, *H. f. and T.*

Fig.—*Roxb. Flor. Ind. ii.*, 570.

Hab.—Central and Southern India. The root.

Vernacular.—Poomichacarei (*Tam.*), Puta-tiga (*Tel.*).

History, Uses, &c.—The earth-sugar root of the Tamils has been used in Hindu medicine in Southern India for many years. In the *Pedatasinth ırmine*, the author says of it: "It cures skin eruptions, all venereal affections, fever, piles, and strengthens the human system." Dr. Ainslie, in his *Materia Indica*, ii., page 330, says: "This root in external appearance is not unlike liquorice root; it also somewhat resembles it in taste, but is not nearly so sweet; it is prescribed, in decoction, as an alterative and diet drink." The drug is used by Mahomedans and Hindus as a sexual stimulant and tonic, anti-syphilitic, and alterative. It can be used either in a fresh or dried state. The outer brown covering is supposed to be harmful, and is removed previous to use. Dr. P. S. Mootoosawmy, of Tanjore, has used the root in his medical practice, and on his forwarding a flowering and fruiting specimen of the plant to Mr. Lawson, of the Madras Botanical Department, it was identified as *Mærua arenaria.* Roxburgh describes the plant under the name of *Capparis heteroclita*, R., and remarks that the unripe fruits are boiled and eaten by the natives.

Description.—*Mærua arenaria* is a large, unarmed, climbing shrub; leaves elliptic; corymbs terminal; calyx four-cleft; corolla regular, four-petalled; stamina on the receptacle, which is as long as the tube of the calyx. The most remarkable part of the plant is the fruit; this is a beaked berry, two to five inches long, deeply constricted between the seeds, fleshy, elongate, moniliform, one or more seeded. There is only one seed in each single berry or lobe of the compound fruit.

The roots are plump when fresh, from 1 to $1\frac{1}{2}$ inches in diameter, long, cylindrical, contorted, with a light brown surface. When dried they become darker in colour and wrinkled longitudinally, and several

irregularly-disposed transverse markings of a lighter colour are observed on the surface. The transverse section of the root exhibits a central hard woody centre of a yellowish colour, and several similar but smaller bundles are scattered throughout the waxy-looking parenchyma of the cortical portion. In the bazars the drug is sold in the shape of circular discs like calumba root, having been sliced transversely in a fresh state and allowed to dry in the sun. Sections of the root examined by the microscope exhibited no starch or crystalline matters in the cells, but yellow granular matter and oil globules were present. The central woody column and woody bundles in the cortical portion were made up of large lignified cells. The taste is sweet and mawkish, and there is no distinctive odour as there is in liquorice root.

Chemical composition.—The finely powdered root lost 11·26 per cent. of moisture, and left 6·6 per cent. of mineral matter when ignited. The ether extract amounted to 4·22 per cent., and consisted of fatty acids of a brownish colour and fluid consistence. After standing a few days, white crystals formed, which were collected and pressed between folds of blotting paper, and recrystallised from boiling alcohol. This insoluble portion had the melting point (62° C. and properties of palmitic acid. Oleic acid was present in the fluid portion of the extract.

The alcoholic extract contained a large quantity of crystalline saccharine matter, which reduced Fehling's solution to a very slight extent. A small quantity of an organic acid was removed from solution by plumbic acetate, but no substance similar to glycyrrhizin could be detected. The absence of an alkaloidal principle was proved after the application of the usual reagents.

The aqueous extract contained an additional quantity of sugar, and when heated to the boiling point threw out an abundance of white flocks of albumin. A larger quantity of the root was exhausted directly with water, the extract heated to separate the insoluble albumin, and filtered. The syrup was then boiled in an inverted condenser with 1 per cent. sulphuric acid for three hours. The sulphuric acid was removed with barium hydrate solution, and the sugar in the syrup estimated with Fehling's test indicated the presence of 41·2 per cent. of invert sugar. This sugar showed no disposition to crystallise, and when examined in a Laurent's polariscope, it had no action on polarised light.

CARYOPHYLLEÆ.

False Bikh or Bikhma.

Towards the end of 1891 certain medico-legal exhibits were received in the Chemical Examiner's Department, Calcutta, from the Mongyr District, including a parcel of roots labelled *Bikhma.* Bickhma or Bishma, we may mention, is the vernacular name for *Aconitum palmatum*. Specimens were sent for identification to the Calcutta Bazaars, and recognized as Bikhma; we also forwarded some to Nepal, where it was recognized, and stated to be sold as Bikhma in the Bazaars. Up to this period we had had no opportunity of examining authentic specimens of Bikhma, and being doubtful whether the drug we had received from Mongyr was true Bikhma or not, we forwarded a sample to Dr. Dymock, Bombay, who reported as follows:—"They appear to be the rhizomes of an aroid, and are not unlike those of the genera Lagenandra, Arum, and Cryptocoryne. They have been cured by some smoking process, have a strong tarry odour, and are somewhat translucent, tough, and flexible. They have no resemblance in structure to any kind of aconite. I have never seen them before." Dr. D. Prain, of the Royal Botanic Gardens, Seebpore, to whom we also submitted a specimen, wrote: "I cannot identify it for certain, but it is, I think, a leguminous rhizome. It might be a glycyrrhiza." Subsequently Dr. Dymock kindly sent us a specimen of true *A. palmatum*: "some of the same batch I sent to Flückiger, and which was examined by Shimoyama. I kept it as being a remarkably fine sample; as the drug is expensive, it may be adulterated with aconite. Rs. 6 per lb. is the price, and aconite is only 9 annas." His sample, when compared with ours, was wholly dissimilar. Under the circumstances we thought it might be of interest to examine the spurious Bikhma, and our results are embodied in this note. In the condition in which the roots were received they were so horny that it was impossible to powder them, and they were cut into fragments, exposed to a temperature of about 80° C. for some time, allowed to cool, and then at once pulverised. During the process the dust caused watering of the eyes and sneezing. When dried at 100° C. the powder lost 6·23 per cent. of moisture. In extracting the powder 315·5 grammes were exhausted with boiling rectified spirit, and the tincture evaporated on a water-bath until it ceased to smell of alcohol. The resulting extract was of a dark

brown colour and of the consistence of treacle. The marc left after extraction with boiling spirit was repercolated with 250 c.c. cold spirit containing 1 per cent. of tartaric acid, and the spirit evaporated off at a low temperature. The two extracts were now mixed with water containing 2·5 grammes of tartaric acid, and the mixture agitated with light petroleum ether. During agitation a few yellowish flocks separated. The petroleum ether extract amounted to 1·173 per cent., calculated on the root containing 6·23 per cent. of moisture. The petroleum ether extract was yellowish-brown in colour, semi solid in consistence, and waxy in odour. The taste was nauseous, recalling croton oil. In absolute alcohol it was wholly soluble with strongly acid reaction. On spontaneous evaporation of the alcoholic solution, a yellow transparent mass was left at the bottom of the beaker, while on the sides the deposit was yellowish-white and opaque. On microscopic examination, it appeared as minute needle-shaped crystals. An attempt was made to separate the petroleum ether extract into fractions, and with this object it was gently warmed with proof spirit, which dissolved a certain amount, and the extract was thus roughly divided into a soluble and insoluble residue. The proof spirit solution, on spontaneous evaporation, deposited soft orange resinous matter, while some white deposit separated on the sides of the capsule. This was found to consist of oil globules, and a few minute needle-shaped crystals. In addition to oil and resinous matter possessing an acid reaction, the presence was also detected of an alkaloidal principle soluble in ether, which afforded marked indications with the usual reagents. With Fröhde's reagent no change was observed in the cold, but a dirty blue developed on gently warming. The portion of the petroleum ether extract insoluble in proof spirit was boiled with alcoholic potash, the solution evaporated to dryness and treated with water. The aqueous solution was turbid from the separation of brown flocks. The turbid solution was agitated with petroleum ether. The ethereal extract had a camphoraceous and terebinthinate odour, was of an orange colour, and had a melting point of 62° C. It was not further examined. The aqueous soap solution was decomposed by dilute sulphuric acid and agitated with ether. The ether extract was converted into a lead soap and reagitated with ether. The soluble lead soap, after separation of lead, afforded a residue which was liquid at ordinary temperatures and of a reddish-brown colour. When agitated with a freshly prepared solution of nitrate of mercury, it solidified to a yellowish

mass. The insoluble lead soap, after separation of lead, afforded a residue which was solid at ordinary temperatures, and had a melting point of 48°. Neither of these fatty extracts was pure, and no attempt was made to ascertain whether they consisted of single acids or mixtures. The presence of glycerine was determined in the original aqueous sulphuric acid solution. The aqueous acid solution of the alcoholic extract of the roots, after treatment with petroleum ether, was agitated with ether. The ethereal solution was allowed to evaporate spontaneously, and the final desiccation conducted over sulphuric acid. The non-crystalline residue was dark brown and tacky with tar-like odour; it amounted to ·123 per cent., calculated on the roots containing 6·23 per cent. of moisture. Warmed with distilled water, a part of the extract dissolved, the solution affording the following reaction:—

Reaction, strongly acid.
Fe^2Cl^6 gave a dirty greenish coloration, passing rapidly to dirty brownish.
$AgNO^3$, slight turbidity; on warming Ag. reduced.
Aqueous NH^3, orange yellow coloration.
Acetate of lead, dirty yellowish, white ppt.
Gelatine, no precipitate.
KCN., no reaction.

That portion of the ether extract insoluble in warm water was treated with aqueous NaHO, and the dark brown solution which resulted agitated with ether. The ether solution exhibited slight fluorescence, and on spontaneous evaporation afforded a yellow crystalline deposit, which appeared as needles and rosettes on microscopic examination. By treating this residue with proof spirit a certain amount of neutral resinous matter of a yellow colour was separated. This was precipitated on dilution with water. The insoluble crystalline residue afforded no crystalline sublimate when heated between watch glasses. The aqueous soda solution of the ether extract was mixed with dilute sulphuric acid and reagitated with ether. The ethereal extract was of a yellowish-brown colour, strongly acid in reaction, and had the properties of an acid resin.

The tartaric acid solution of the alcoholic extract of the drug was now mixed with a very slight excess of sodium bicarbonate and again agitated with ether. After agitation and on subsequent standing, a small quantity of a white crystalline substance separated, which

floated on the water stratum below the ether. The ether was separated and allowed to evaporate spontaneously, the extract amounte to ·048 per cent.; it formed a yellow transparent varnish on the sides of the capsule, while at the bottom it was white, chalky, and indistinctly crystalline; odour, aromatic. The chalky deposit consisted of some irregularly-shaped plates and amorphous particles. The yellow varnish-like residue was easily soluble in proof spirit, but neither this portion nor the chalky deposit afforded any reaction with alkaloidal reagents. The chalky deposit treated with concentrated H^2SO^4 afforded a yellow solution in the cold, changing to pinkish on standing for some time, but on heating the pink colour was developed rapidly. Nitric acid, no reaction. Fröhde's reagent, greenish in the cold, passing to blue on warming. Ferric chloride, no reaction Heated with dilute aqueous H^2SO^4 and the solution neutralised it reduced an alkaline copper solution on boiling. When agitated with water, considerable frothing was noted. A small amount injected, mixed with water, into a cat's stomach induced no symptoms When applied to a cat's eye, there was no change in the size of the pupil observed. The yellow varnish-like deposit separated from the chalky deposit, by the action of proof spirit, when injected into a cat's stomach caused the animal to vomit once a small quantity of frothing liquid; one formed stool was also passed, but no other symptoms were noted. The varnish-like residue, when applied to the tip of the tongue, produced a slight sensation of tingling or numbness, which lasted for a short period, and could not be mistaken for the symptoms induced by aconitine.

The alkaline aqueous solution of the alcoholic extract was next agitated with chloroform. The extractive was yellowish-brown, with an odour like that of gum benzoin, and amounted to ·064 per cent. In *cold* proof spirit it was partly soluble, the solution on spontaneous evaporation affording a residue which contained a few microscopic plates. The residue insoluble in cold proof spirit was pale yellow and soluble in boiling proof spirit. On spontaneous evaporation a white crystalline deposit was obtained, consisting of bundles of rods and a few plates. The residue frothed when agitated with water, and when treated with concentrated sulphuric acid yielded a rose coloration. The alkaline aqueous solution of the alcoholic extract was finally agitated with amylic alcohol. The extract amounted to 1·582 per cent., and formed a transparent, soft, viscid residue of

a reddish-yellow colour, non-crystalline, and frothing considerably with water. In warm water it dissolved, forming a clear solution, which became turbid on cooling. An attempt was made to decolourise the aqueous solution by agitation with purified animal charcoal, but very little colouring matter was thus removed. As neutral salts, as NaCl, $MgSO^4$, gave a white curdy precipitate from the aqueous solution of the extract, an attempt was made to separate the saponin-like principle by saturating the watery solution with $MgSO^4$; it was found, however, that the flocks agglutinated together, forming a sticky mass, and filtration was impossible. Baryta water was next used for separating the principle. With this object the amylic alcohol extract was dissolved in water and excess of aqueous barium hydrate added. The turbid mixture was then filtered (filtrate A), the precipitate was washed with baryta water and transferred to a beaker, water added, and CO^2 passed for a considerable time. The turbid mixture was then evaporated to dryness on a water-bath, and exhausted with rectified spirit, the filtered alcoholic solution was evaporated to dryness, and left a scaly, friable, shining residue, which afforded the following reactions:—With concentrated H^2SO^4 a yellow coloration, changing to red. Concentrated HNO^3, yellow. In concentrated HCl it dissolved freely, forming a faint pinkish coloured solution, the colour deepening on the application of heat, and a few flocks separating. In strong acetic acid it was also readily soluble, forming a colourless solution, no change being induced by the subsequent addition of potassic dichromate. When heated with aqueous phosphoric acid it did not yield a clear solution, no colour developed, and no odour. With aqueous ammonia it was sparingly soluble; no precipitate with acetic acid; the ammoniacal solution frothed on agitation. Boiled with dilute HCl, it afforded a solution which reduced alkaline copper. The amount of principle precipitated by baryta was small, and though this principle afforded some of the reactions of saponin, it seemed probable that the greater part was still present in the filtrate.

A fresh portion of the original amylic alcohol extract was dissolved in water, and treated with lead acetate, which afforded a white curdy precipitate, after separation of lead by H^2S, yielded extracts which frothed strongly on agitation with water, and gave some of the reactions of saponin. The amount of extractive yielded was, however, small, and it appeared to us that probably both the

lead precipitates were either unstable compounds of a saponin with that metal, from which the greater part of the principle could be separated by washing, or that they consisted chiefly of easily soluble lead salts of a saponin, or of a lead salt of a saponin mechanically mixed with a saponin precipitated by the action of lead acetate, in the same manner as we have found certain neutral salts to act. But, on the other hand, it was possible, assuming the existence of more than one saponin-like principle in the plant, that one saponin formed a stable and insoluble lead compound, the other an unstable or soluble salt. And similar remarks might also apply to the barium hydrate precipitate.

As bearing on these points the following experiments were made:—The amylic alcohol extract was dissolved in water, excess of lead acetate added, and the turbid mixture repeatedly agitated with amylic alcohol. During agitation the greater part of the precipitate agglutinated, forming a yellow viscid coating on the bottom and sides of the bottle. This deposit appeared to be very slightly soluble in amylic alcohol. It was soluble in acetic acid, and the acid solution, when agitated with amylic alcohol, afforded an extract which frothed with water, and yielded certain of the reactions of saponin. The viscid deposit from which this extract was obtained would therefore appear to represent a saponin, which formed a stable lead compound, only slightly soluble in amylic alcohol. The original amylic alcohol solution was next examined to ascertain if it contained any saponin-like principle or not. It was first filtered, and then evaporated to dryness on the water-bath. The residue was yellowish and brittle, and contained a small quantity of lead. The amount of extract was far larger than that obtained from the viscid deposit after decomposition with acetic acid. Lead was removed by dissolving the extract in water and passing H^2S. The filtered solution was then evaporated to dryness, the residue reduced to fine powder and repeatedly agitated with ether, which removed some colouring matter and traces of amylic alcohol. The resulting powder was white and free from odour. It afforded the following reactions:—With cold water it formed a slightly opalescent solution, which frothed considerably on agitation. Concentrated H^2SO^4 at first faint yellow, changing to pink, carmine, with violet at the edges on standing, and green on the addition of potassic dichromate. Concentrated HNO^3 colourless, yellow on the addition of dichromate,

and changing to blue on standing for some time. In concentrated acetic acid, readily soluble, forming a colourless solution. Soluble in dilute ammonia, forming a solution which frothed, and from which acetic acid gave a white precipitate on neutralisation. Caustic soda, similar reactions to ammonia. Tannic acid, a white precipitate. Ferric chloride, a turbidity in the cold, which disappeared on heating, the solution being of a brown colour. On boiling with dilute HCl, dark brown, oily globules separated, and the solution reduced alkaline copper. This decomposition product did not appear to possess the properties of the principle described as *sapogenin*, obtained by the action of dilute acids on ordinary saponin. The ash amounted to ·47 per cent.; it was free from lead.

To determine the ultimate composition of this saponin, it was dried over sulphuric acid in a vacuum, and the combustion made in an open tube in a current of oxygen, and the results afforded the following percentages:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	60·92	61·18	61·05
Hydrogen ...	8·93	8·74	8·84
Oxygen... ...	30·15	30·08	30·11
	100·00	100·00	100·00

From these percentages a formula $C^{32}H^{54}O^{12}$ was deduced—

	Calculated for $C^{32}H^{54}O^{12}$.	Found.
Carbon	60·95	61·05
Hydrogen	8·57	8·84
Oxygen	30·48	30·11
	100·00	100·00

In another experiment a somewhat different mode of extracting the saponin was adopted. An alcoholic extract was obtained from another sample of *Bikhma*, no acid being used in the extraction. The alcoholic extract was mixed with water and directly extracted with amylic alcohol, without previous treatment with petroleum ether, ether, and chloroform. The amylic alcohol containing the crude saponin was separated, filtered, and then repeatedly agitated with aqueous basic lead acetate. During agitation the yellow viscid

matter, already mentioned, separated on the sides of the bottle. The agitation with basic lead was continued for a considerable time, until colouring matter ceased to be dissolved. The amylic alcohol was then allowed to stand for some days, filtered, and evaporated on a water-bath. The extract was next taken up with water, and lead removed by H^2S. After filtration the solution was again evaporated to dryness, the extract reduced to powder, and repeatedly agitated and digested with ether. The saponin extracted in this manner had a faintly yellowish colour, and contained 6 per cent. of ash free from lead. After drying over sulphuric acid *in vacuo*, the following results were obtained on ultimate analysis:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	60·12	60·21	60·165
Hydrogen	8·35	8·54	8·445
Oxygen	31·53	31·25	31·390
	100·00	100·00	100·000

Some of the saponin used for the last analysis was subjected to a further process of purification. It was dissolved in amylic alcohol, and the solution repeatedly agitated with aqueous barium hydrate. On evaporating the amylic alcohol solution to dryness, and heating the powdered extract with ether to separate traces of amylic alcohol, the saponin was left as a white powder which contained ·308 per cent. of ash. On ultimate analysis, the following percentages were obtained, the saponin being dried *in vacuo* over sulphuric acid:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	59·90	59·82	59·86
Hydrogen... ...	8·64	8·62	8·63
Oxygen	31·46	31·56	31·51
	100·00	100·00	100·00

It seems likely to us that the last sample of saponin isolated was the purest of the three examined, though we are not prepared to definitely assert it was a *pure* saponin. We have adduced some evidence which tends to indicate that at least two saponins exist in false Bikhma, and it is possible that the method we used for separation

afforded a mixture. It was our intention to have determined the ultimate composition of the saponin in combination with lead, to which we have referred as a "viscid yellow compound," and to have examined the product yielded by the hydrolysis of the saponin, but we were unable to complete our research.

The results of the proximate analysis of the false Bikhma may be stated thus :—

Moisture	6·23
Petroleum ether extract... ...	1·173
Acid ether extract	·123
Alkaline ether extract	·048
Chloroform extract	·061
Amylic alcohol extract	1·58

We also append the results of an analysis of the specimen of *A. palmatum* referred to above. Our 100 parts afforded the following results when examined by Dragendorff's method :—

Petroleum ether extract... ...	·040
Ether extract	·048
Absolute alcohol extract... ...	·150
Water extract	2·40

An alcoholic extract affords the following percentages :—

Petroleum ether extract	·946
Acid ether extract	·310
Alkaline ether extract	·371
Amylic alcohol extract	·976

The compositions of these extracts we were also unable to examine.

We may summarise our results by stating that the most important constituents of false Bikhma are saponin, and as bearing on the identification of the plant which yields the drug, we would refer to Aitchison's "Notes on Products of Afghanistan and Persia," in which it is stated that the name *Bekh* is technically applied to the root-stocks of *Acanthophyllum macrodon* and *Gypsophila paniculata.* These are both used as soaps, and possibly false Bikhma may be derived from one of these plants. (*C. J. H. Warden and Assistant Surgeon Chuni Lal Bose in "Pharm. Journ.," October* 15*th*, 1892, *p.* 302.)

PORTULACEÆ.

Chemical Composition of Portulaca oleracea.

Water	92·61
Nitrogenous substances	2·24
Fat	0·40
Non-nitrogenous extractive	2·16
Cellulose	1·03
Ash	1·56
In dry substance—	
Nitrogen	4·85
Carbohydrates	29·23

(*König, Nahrungs Mittel*, p. 147.)

TAMARISCINEÆ.

Remarks on the substance called Gez or Manna found in Persia and Armenia.

At entertainments in Persia a sweetmeat called *Gezangabeen* is usually met with, the pleasant taste and other singular properties of which, as well as the mystery that involved its origin, excited my curiosity to know if it were an animal or a vegetable production.

The principal ingredient in its composition is a white gummy substance called *Gez*, which, when mixed up with rose-water, flour and pistachio nuts into flat round cakes that are generally made three inches in diameter and a quarter of an inch thick, has much the appearance and feel of common dough, though a little more hard. It is at the same time both adhesive and brittle, for any attempt to cut it shows the former quality, as it sticks to the knife; and if pulled, it admits of being drawn out to some length like birdlime. The mode, however, generally practised of breaking it for use is by placing one cake on the palm of the hand somewhat hollowed and striking it with the other, when the blow occasions it to fly into several pieces, whose edges, rather unexpectedly, appear smooth and polished like broken glass.

Collection.—Before daylight we marched from Khonsar, and, on clearing the boundaries of the town, deviated from the main road as we had been directed, and began rambling amongst the bushes on the face of the mountain on our right, diligently looking for the *gez*. The directions we had received were to examine the bushes closely, as the

object of our search was not easily visible at any distance ; too much confidence, however, in the knowledge of our servants and guide who, with true Persian effrontery, asserted they were familiar with the appearance of the *gez*. in its natural state, nearly occasioned us a complete disappointment. We had relinquished the pursuit in very ill-humour, to resume our journey, when we met, as chance would have it, two peasants proceeding to the spot we had just quitted : as usual, we accosted them, and were not a little pleased at hearing they were the people whose occupation it was to gather the *gez*. These men were furnished with a stick three-fourths of an inch in diameter and curved at the further extremity, which was covered with leather, and a kind of oval leathern bowl, near three feet long and two broad, with a handle to it, resembling an egg-shell cut in two longitudinally. Besides these, they had a sieve suspended from the right side, to free the *gez* from the insects and small pieces of leaf that generally fall with it when first beat from the bush : the bottom of the sieve was of coarse woollen cloth.

The countrymen were easily persuaded by a trifling present to fall immediately to work and show us a specimen of their employment. They turned off the road a few yards amongst the bushes we had just quitted, and placing the leathern receptacle underneath, they beat the bushes on the top with the crooked stick; in a few minutes they had obtained a handful of a white kind of sticky substance not unlike hoar frost, of a very rich sweet taste: this, after being purified by boiling, is mixed up into the sweetmeat before mentioned under the name of *gezangabeen*.

Though the *gez*, when fresh gathered from the *gavan* bush, admits of being sifted, still in this original state it is brittle and adhesive at the same time, qualities for which it is so remarkable after its preparation as a sweetmeat. If pressed, it sticks to the fingers ; but on being smartly struck with a bit of wood separates easily into small grains like lump-sugar. It is in this state in cool weather, or when the thermometer does not exceed 68° F. ; but liquefies on being exposed to a higher temperature, resembling white honey both in colour and taste.

The shrub on which the *gez* was found is called the *gavan* ; it grows from a small root to the height of about two feet and a half, spreading into a circular form at the top from three to four feet and

a half in circumference. Captain Stewart, the gentleman with whom I was travelling, remarked that it had a striking resemblance to the broom, but it did not, we were informed, bear a yellow flower. The leaves were small and narrow, and underneath we saw the *gez* spread all over the tender branches like white uneven threads, with innumerable little insects creeping slowly about.

These little creatures appeared to derive their subsistence from the leaves and young bark of the bush they inhabit; and this is the opinion of the country people. They are either three distinct species of insects, or one in three different stages of existence: one kind is perfectly red, and so diminutive as to be scarcely perceptible; the second, dark and very like a common louse, though not so large; and the third, exactly like a very small fly. They are extremely dull and sluggish, and are found lying or creeping about between the bark of the *gavan* and the *gez*. The peasants, as well as the inhabitants of Khonsar, were decidedly of opinion that this curious substance is the production of these minute animals, as neither the insect nor the *gez* are found on any other tree in the neighbourhood; nor can we be allowed to imagine it may be a vegetable gum, as no appearance of any gummy liquid oozing from fissures in the bark of the bush could be observed on the closest examination. The people who are engaged in the collection of this curious article continue their occupation every third day for twenty-eight days during September. A journey, which I subsequently made to Baghdad, convinced me that the *gez* is not exclusively confined to this district, but is found in the range of mountains running through Koordistan, dividing Persia from Asia Minor and Mesopotamia, where it is called manna by the Armenians, and said to be exported in quantities through Erzeroom to Constantinople. (*By Captain B. Frederick, from the "Transactions of the Literary Society of Bombay," September 28th*, 1813.)

Note.—The *gavan* is *Tamarix gallica*, var. *mannifera*, Ehrenb., and the aphis, which feeds upon it and produces the *gez*, is the *Coccus manniparus* of Ehrenberg. The name Gezangabeen is loosely applied by the Persians to the true manna obtained from *Cotoneaster nummularia* in Korasan, the correct name of which is *Shirkhisht*.

TERNSTRŒMIACEÆ.

Camellia theifera, *Griff.*

Tea seeds contain 35 per cent. of a somewhat thinly fluid, tasteless, inodorous oil, of a straw to amber colour, which resembles olive

oil. At 15° C. it has a sp. gr. of ·9270; at 38° C. it forms an emulsion and solidifies only below—5° C. It is scarcely soluble in spirit of wine, and very sparingly in ether. Chemically, it consists of 25 parts stearin and 75 parts of olein. In China it is used as a table and lamp oil and for the manufacture of soap, for which it is specially well adapted, yielding a beautiful hard soap.

Tea oil has been used in China for a very long time, but has been only recently introduced into commerce. *C. oleifera* and *C. drupifera* yield oil for household purposes similar to the above. (*Brannt.*)

Caffeine and Theine: their identity, and the reactions of Caffeine with Auric Chloride.

In consequence of the conclusions of Mays (*Journ. Physiol.*, 7, 458: *Therapeutic Gazette*, 1866, 587), and more recently of Lauder-Brunton and Cash (*Proc. Roy. Soc.*, 42, 283; *Journ. Physiol.*, 9, 112), that the physiological action of theine obtained from tea differs in certain respects from that of caffeine obtained from coffee, the authors have searched for evidence of isomerism in these bases, the existence of which is not put beyond doubt by the chemical comparison of them which has hitherto been made.

Having extracted theine from tea and caffeine from coffee, it is shown that the two substances exactly resemble each other, and melt at precisely the same temperature, *viz.*, 234°·5 (corr.). From each base the crystalline *aurochloride* ($C^8H^{10}N^4O^2$, HCl, Au $Cl^3$2 H^2O) was prepared, and these two salts both melted at 242°·5 (corr.). When dried at 100°, they both lost the equivalent of two molecular proportions of water, and the anhydrous salts melted at the same temperature, *viz.*, 248°·5 (corr.). The analytical data corresponded with the formulæ given above. The complete correspondence in the properties and composition of the aurochloride is satisfactory evidence of the absence of a structural difference in the bases. In order to further confirm the identity of the two substances, a specimen of each was converted into the mercuric chloride compound (C^8H^{10} N^4O^2, $HgCl^2$), a stable crystalline salt. Both preparations were found to melt at the same temperature, *viz.*, 246° (corr.), and to exactly correspond with each other in other respects.

The complete identity of caffeine and theine having thus been demonstrated, the observed differences in their physiological action must be ascribed either to impurities in the specimens used, or to

variations in the animals employed in the experiments. The circumstance that theine was found to be more active than caffeine, and to be capable of producing effects not produced by caffeine, tends to support the view that the theine was impure. It is now well known that tea contains other bases than caffeine, the presence of traces of which might be sufficient to account for the observed differences.

During the preparation of the pure aurochlorides for a comparison of their properties the authors obtained two new and interesting auric derivatives of caffeine.

When an aqueous solution of caffeine aurochloride is heated, a yellow, flocculent precipitate is gradually formed, which is insoluble in alcohol, chloroform, and ether, but dissolves in hydrochloric acid, reproducing the aurochloride. The substance dried at 100° forms a pale yellow amorphous powder, which melts at 207° (corr.). Analysis proved it to be aurochlor caffeine $C^8H^9(AuCl^2)N^4O^2$, a substance in which one atom of hydrogen in caffeine is replaced by the group $(AuCl^2)$. It is pointed out that the ready formation of this remarkable compound from caffeine aurochloride by the loss of two molecular proportions of hydrochloric acid—$C^8H^{10}N^4O^2$, HCl, $AuCl^3 = 2\,HCl +$ $C^8H^9\,(AuCl^2)\,N^4O^2$—is better shown by Medicus's formula for caffeine, than by that proposed by Emil Fischer, since in Medicus's formula the CH group which loses hydrogen is represented as contiguous to the doubly-linked nitrogen atom, to which the auric-chloride is attached.

By the reaction of an alcoholic solution of potassium chloraurate (KCl, $AuCl^3$) with a solution of caffeine in chloroform, a salt, crystallizing in the dark red needles, was obtained. This is shown to be caffeine potassium aurochloride ($C^8H^{10}N^4O^2$, KCl, $AuCl^3$) which differs from caffeine aurochloride in containing potassium in the place of the hydrogen of hydrochloric acid. This salt melts at 208° (corr.). It readily dissolves in alcohol and water, forming yellow solutions which appear not to contain the salt itself, but its constituents, caffeine and potassium chloraurate. The salt is nearly insoluble in ether and chloroform, but prolonged contact with these liquids leads to its decomposition into caffeine and potassium choloraurate (*W. R. Dunstan and W. F. J. Shepheard, from the Research Laboratory of the Pharmaceutical Society—The substance of a communication made to the Chemical Society, December 15th,* 1892.)

MALVACEÆ.

Althæa lavateræflora, *DC.*

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 9) notices it as a cultivated plant usually grown on the ridges between fields. It is grown not only for the showiness of its flowers, but for the petals, which are collected as they fall off the plant, and employed in local medicine or exported under the names of *gul-i-khatmi* or *gul-khairu*. The seeds are also collected and sold as *tukm-i-khairu*, and the roots as *reshai-khatmi*. We have received the flowers from Afghanistan, where they are used as a substitute for those of *A. officinalis;* they are very mucilaginous.

STERCULIACEÆ.

Heritiera littoralis, *Dryand., Rheede, Hort. Mal. vi., t. 21.*

The seeds of this plant, common on the coast, have been substituted for white Kola nuts, to which, when the chestnut coloured, papery, episperm has been removed, they bear some resemblance, but are a little larger and nearly orbicular, with a somewhat sinuous instead of an angular outline. Heritiera seeds are from 0·010 m. to 0·015 m. thick, and have a diameter of about 0·04 m.; they are concave on one side and convex on the other, and are composed of two cotyledons, one of which is double the size of the other. Heckel and Schlagdenhauffen (*Nouv. Remèdes*, 1887, p. 155) give the following as the composition of the almond:—

Oil	4·366
Tannin and colouring matter	4·983
Sugar	5·738
Sodium chloride	0·288
Cellulose and starch	55·987
Albuminoids	13·537
Lignin	12·367
Fixed salts	2·645
Loss	0·089

The ash contained traces of iron and manganese, and consisted chiefly of phosphates and sulphates of lime, potash, and soda. No caffeine was found. The seeds are eaten in India, and it is evident from the analysis that they have considerable alimentary value.

Sterculia alata, *Roxb. Bedd. Fl. Sylv., t.* 230.

The kernels contain 45·27 per cent. of a bland oil possessing some siccative properties. Eighteen kernels were eaten by one of us without any symptoms being induced, hence Roxburgh's statement that the seeds under the name of *Toolà* are said to be eaten by natives in Silhet as a cheap substitute for opium is probably based on incorrect information. The tree is one of the largest found in Bengal, and seeds very freely; in our opinion the kernels form a most excellent substitute for ordinary almonds, which they resemble in shape and size. Theobromine and caffeine were specially looked for with negative results.

Sterculia scaphigera, *Wall.*

These remarkable fruits are brought to India by Mahomedan merchants from Java and Singapore by way of Karaikal and Nagore, seaport towns on the Coromandel Coast. They are called Oomas-Mungoo in the Malay language, and are used as a demulcent drink.

Sterculia Gum.

Mr. J. H. Maiden, in an article on Sterculia gum (*Pharm. Journ.* [3], xx., 381), shows in the following table how suitable it is as a substitute for Tragacanth :—

	Sterculia.	Tragacanth.
In cold water ...	*a.* Colourless .. *b.* Granular jelly ... *c.* Adhesiveness absent or very small.	*a.* Opalescent. *b.* Smooth viscid mass. *c.* Adhesive.
Boiling in dilute alkali.	Insoluble	Almost entirely dissolves.
Caustic soda and warming.	No change of colour.	Canary-yellow colour, which fades on cooling.
Boiling in dilute acid.	Soluble, forming arabin (*J. H. M.*).	Soluble, forming pectin (*Giraud*).
Alcohol added to quid formed in (10).	Whitish precipitate (*see* fuller statement).	Formation of floating glairy mass.

He found Sterculia gum to yield to cold water only 3·14 per cent., consisting chiefly of Arabin; 75·1 per cent. of the gum was

found to be Pararabin. The gum contained 16·6 per cent. water, and yielded 5·83 per cent. ash.

Mr. Maiden draws attention to the fact that Pararabin is the chief constituent of the vegetable jellies known as Agar-agar, a Ceylon moss, both of which are used by the natives of India as an article of diet like Sterculia gum, and are supposed to be very strengthening.

A sample of gum said to be from *Cochlospermum gossypium* was found by him to be similar to that of Sterculia, but as it had pieces of lace bark attached to it, it was probably Sterculia gum.

LINEÆ.

Linamarin.

A. Jorissen and E. Hairs (*Acad. roy. de Belgique* (3) 21 (1891), 529) have isolated a glucoside, linamarin, from the germs of *Linum usitatissimum*. The germs, coarsely powdered, were treated repeatedly with boiling 94 per cent. alcohol, the latter recovered and the residue taken up with warm water. The resin and fat are separated, and the aqueous solution treated with a slight excess of lead acetate. After filtration and precipitating the lead with H^2S the liquid is evaporated to a syrupy consistency. This residue is extracted with boiling alcohol, the solvent recovered for the greatest part, and the remaining liquid mixed with ten times its volume of ether under constant agitation. The residue remaining on distilling off the ether is taken up with water and this solution concentrated. Standing over sulphuric acid for some time, the concentrated solution is converted into a crystalline mass of linamarin. For purification it is again treated with ether and alcohol as above. Lastly, the principle is dissolved in two parts of warm absolute alcohol, and the solution cooled under agitation. The germs yield about 1·5 per cent. of the glucoside, which forms colourless needles possessing a refreshing but very bitter taste, is soluble in water and alcohol, but almost insoluble in ether. Concentrated sulphuric acid does not colour it; dilute mineral acids decompose the glucoside into hydrocyanic acid, a fermentable sugar reducing Fehling's test, and a volatile compound possessing some characters of ketones, and giving with iodine and potassium hydrate the iodoform reaction. Boiling barium hydrate liberates ammonia. Linamarin contains C 47·88 per cent., H 6·68 per cent., N 5·55 per cent., O 39·89 per cent. (*Am. Journ. Pharm.*, Dec. 1891.)

Growth of the Indian Linseed Trade.

Dr. G. Watt (*Dict. Econ. Prod. India*, Vol. V., p. 76) shows that the trade has expanded from about 3 cwts. in 1832 to 8,461,374 cwts. in 1888-89.

Erythroxylon Coca grown in India.*

Several samples of *Erythroxylon Coca* leaves, grown in various districts in India, have been examined by Warden; the mode of culture, altitude, and meteorological characters of the district, the kind of soil and manuring, and the methods of curing being taken into consideration. The alkaloid was estimated by Squibb's modified method: the dry pulverized leaves were moistened with alcohol acidified with sulphuric acid, percolated with alcohol, the percolate mixed with acidified water, and extracted with ether, then rendered alkaline with sodium carbonate, and again extracted with ether. This extract was washed twice with water, dried and weighed; the amounts of "crude alkaloid" so determined are given in the following table:—

District where grown.	Moisture.	Per cent. dry leaves.	
		Ash.	Crude akIaloid.
Ranchi, young leaves	6·18	6·71	1·139
" mature leaves	8·22	8·99	0·883
Arcuttipore, Cachar	6·08	7·39	1·369
" "	6·72	6·36	1·671
Darjeeling	10·37	7·58	1·115
Alipore, Calcutta	10·42	10·23	0·358
Matelli	9·30	12·18	1·022
Chulsa, Dooars	5·71	7·62	0·610
Jaunpore	10·05	12·64	0·571

* *Chem. News*, lviii., 249-251, 260-262, 273-276; *Journ., Chem. Soc.*, March, 1889.

The crude alkaloid was very faintly yellow, and in no case showed any tendency to crystallization, although attempts were made to induce crystallization by extracting at various temperatures, and without applying heat, and by employing different acids and solvents. The allakoid obtained is, nevertheless, quite similar to cocaine from other sources in its physiological action, except that it seems to be more active. It dissolves readily in hydrochloric acid, and yields a soluble and insoluble platinochloride, the former containing 18·75, the latter 18·88 per cent. of platinum; discrepancies from the theoretical are assumed to be due to a variable quantity of cocamine (*Hesse, Am. Journ. Pharm.*, 1887, p. 455) in the alkaloid from Indian leaves. Both platinum salts yielded bases producing marked anæsthetic effects on the tongue; Howard has observed that the insoluble platinochloride obtained from other leaves was devoid of this property (*Pharm. Journ. and Trans.*, July 23, 1887). In one instance, stellate crystals of the base from the soluble platinum salt were obtained. Applying Williams' method, the crude alkaloid showed 2·89 per cent. of impurity, but the precipitates were not crystalline. It is noted that after the addition of ether to the acidified alcoholic solution, larger deposits of the sulphur-yellow cocatannic acid were obtained from those samples containing the highest percentages of alkaloids; it is hence suggested that possibly cocaine exists in the leaves as cocatannate.

Methods of cultivating the plants are described: the leaves are first gathered $1\frac{1}{2}$ years after transplanting, subsequently whenever they are sufficiently mature; and, although the method of curing does not appear to affect the quality or quantity of the alkaloid obtained, nevertheless it is best, taking into consideration Paul's experience, to dry them, soon after gathering, at as low a temperature as possible, and when dry and cold to pack them closely in air-tight chests, as they are very hygroscopic. The quantity of alkaloid produced increases with the age of the plants (which attain a height of from 2 to 6 feet) up to 10 years, and after 20 years a slight falling off is observed, although they are in their prime even when 35 or 40 years old.

From the above results, obtained from plants and leaves of various ages, it would seem that, in India, neither altitude nor rainfall have much influence on the proportion of alkaloid in the leaves. The ash, in all cases except one, was white, the exception being an ash of a

reddish hue from mature Ranchi leaves. A partial examination of some of the ash showed that they contained the following percentages :—

Samples from	Soluble constituents.	K cal. as KHO.
Darjeeling	44·42	29·26
Alipore, Calcutta	34·60	19·13
Arcuttipore, Cachar	59·02	29·84
Matelli	64·17	31·36

So that both nitrogenous and potash manures will probably be required in the future to keep up the yield from the same plantation.

Fruit of Erythroxylon Coca.

The fresh ripe fruit weighed, on an average, ·158 gram each ; they were bright scarlet in colour, and possessed a distinctly sweetish taste, but though masticated at various times, no physiolgical action on the mucous membrane of the mouth was observed. Dried in vacuo over sulphuric acid, the original tint was only slightly deepened, and this method of desiccation was employed in preparing the fruit for analysis.

Microscopically described, the fruit from without inwards presents first a single row of brick-shaped cells forming the epidermis ; within them is a single row of very large cells containing a mass of starch granules and scarlet colouring matter. Next comes the pulp, composed of parenchymatous cells, containing starch and granular matter. Then the shell, composed of an outer layer of stony cells, like bone cells, which are of considerable length ; within this layer is a row of scalariform vessels, and then several rows of pitted vessels. Then the almond, the cells of which are full of starch.

The petroleum ether extract was a deep reddish semi-solid residue, which, on microscopic examination, was found to contain lamellæ and needles of a claret colour. It contained no alkaloid, and melted at 34—35° C. A portion was saponified with alcoholic potash, and when cold agitated with ether. At 189—191° this extract melted to a clear yellow liquid, which cooled to a brittle transparent mass. Heated between watch-glasses for several days, a white sublimate was obtained, but the amount was far too small to admit of a melting point

determination, or the application of other tests, in order to establish the identity of this compound with phytosterin or analogous cholesterin-like principles. The fatty acids melted at 53—54°.

The powdered fruits were then exhausted with ether, which dissolved out an alkaloid, having a slight numbing sensation on the tongue, and appearing to be cocaine.

Absolute alcohol then removed cocatannic acid and an alkaloid; and finally water extracted colouring and albuminous matters, and something which reduced alkaline copper solution on boiling.

The percentage composition of the fruit as deduced from the examination may be arranged as follows:—

Moisture lost at 100° C. after partial desiccation over sulphuric acid...	5·423
Ash	4·271
Petroleum ether extract containing 3·021 per cent. of glycerides of fatty acids, and 1·519 per cent. of impure phytosterin (?) with colouring matter... ...	4·540
Ether extract, soluble in petroleum ether ·232 per cent., soluble in water and containing cocaine ·11 per cent., soluble in absolute alcohol ·069 per cent., soluble in ether but insoluble in petroleum ether, alcohol or water ·029 per cent.	·440
Absolute alcohol extract containing cocatannic acid and a trace of alkaloid	3·820
Aqueous extract	23·440

(*C. J. H. Warden, Pharm. Journ.*, July 5th, 1890.)

RUTACEÆ.

Oil of Lemon.

V. Olivieri (*Gazz. Chim.*, xvi., 318) found in oil of lemon, besides the limonene (Wallach), also another terpene $C^{10}H^{16}$, boiling at 170—170·5° C. (338—339° F.), the tetrabromide of which fuses at 31° C. (88°F.), but the dihydro-chloride showing the characteristics of limonene. From the higher boiling portions the author has furthermore isolated a sesquiterpene $C^{15}H^{24}$, boiling at 240—242° C. (464—468° F.), which increases in quantity with the age of the oil. For detecting adulteration with turpentine, the author recommends the use of the polarimeter. Lemon oil is lævogyre

$(\alpha)_D = -55°$, while oils of turpentine are more or less dextrogyre. (French oil of turpentine is lævogyre.) (*Am. Journ. Pharm.*, Dec. 1891.

Neroli oil.

In order to be able to submit neroli oil to a closer examination, Messrs. Schimmel obtained in the spring of last year, from the Riviera, a large quantity of the flowers of the bitter orange. The blossoms were consigned preserved in diluted sea-water, and were received in good condition with the full odour of fresh flowers. From the equivalent of 560 kilos of fresh flowers, there was obtained by a process of cohobation 0·460 gram of pure neroli oil, which in many respects differed from the best French distillates met with in commerce. It had a specific gravity of 0·887, and was optically inactive. Already at a temperature of + 11° C., it showed an abundant separation of a solid body in fine shining scales. At 0° the oil solidified to a mass of the consistence of butter. The stearoptene of neroli oil, like the stearoptene of rose oil, appears to be a paraffin-like body; it can be separated from the liquid portion of the oil by the addition of 90 per cent. alcohol, in which it is difficultly soluble. The specific gravity of eleven samples of commercial neroli oil obtained from the best sources varied between 0·875 and 0·886 at 15° C. Of nine oils, one was optically active, whilst the others were all dextrorotatory, the rotation varying between + 0°52′ and + 9°40′. Only one solidified at 0° C., the others remained liquid and did not show any separation of stearoptene upon the addition of 90 per cent. alcohol. The cause of these differences between Messrs. Schimmel's distillate and commercial samples is not explicable without further investigation.

Ægle Marmelos.

The extract from the flower, called in English Marmel water, and known in Sinhalese as "Pinidiya," is used by the natives as scent one festive occasions. It is also sometimes added in the preparation of, sweetmeats for flavouring them. During the flowering season, boys and men in the villages surrounding Colombo may be seen plucking the flowers and bringing them in baskets to the town for sale, wher they are readily bought for distillation. An infusion of the flower is also used as a cooling drink. (*H. D. Lewis in "Trop. Agric.,"* Sept. 1889, p. 218.)

SIMARUBEÆ.

Quassine.

Oliveri and Denaro give the following mode of preparation of quassine (*Gaz. Chim. Ital.*, No. XIV.): Infuse for six hours 10 kilograms of powdered quassia with 45 liters of boiling water, taking care to retain the heat. Decant the liquid and make a second infusion. Unite the liquors and evaporate to 10 liters, filter and precipitate with q. s. of tannin. Place this impure tannate of quassine upon a filter, wash carefully, dilute with water, treat with carbonate of lead, and dry in a water-bath. Treat the tannate of lead and quassine two or three times with boiling alcohol, and distil the united liquors. The residue deposits crystals of quassine mixed with resinous matter. Purify by repeated crystallizations in alcohol and water. Thirty kilograms of quassia give 10 grams of pure crystallized quassine. Evaporations should be made slowly and alkaline reactions should be avoided.

BURSERACEÆ.

Chemistry of Myrrh.

Dr. Oscar Köhler publishes the results of a chemical examination of Myrrh from Sumali (*Archiv.*, June 2, 1891, p. 291): Ash 2·79 per cent., portion soluble in water 57 to 59 per cent., consisting of a gum, $C^6H^{10}O^5$. The portion soluble in alcohol was a mixture of resins. The greater portion was an indifferent soft resin (C) soluble in ether, $C^{26}H^{32}O^9$. Two bibasic acid resins, one (A) $C^{13}H^{16}O^8$, and the other (B) $C^{26}H^{32}O^9$. The essential oil 7 to 8 per cent.; the principal constituent corresponds to the formula $C^{10}H^{14}O$. If the formula for A resin be doubled, all three formulæ will contain 26 atoms of carbon, and the resins differ in the amount of oxygen they contain—

Indifferent resin C = $C^{26}H^{31}O^{2}(OH)^3$.
Resin acid B = $C^{26}H^{32}O^9$.
Resin acid A = $C^{26}H^{32}O^{16}$.

MELIACEÆ.

Naregamiaalata.

Naregamia has been physiologically investigated by Dr. Stefan Schœngut of Vienna. He used it in 24 cases, namely, one of dysentery

one of pleurisy, two of pneumonia, four of emphysema, five of bronchitis, five of heart failure, and seven of tuberculosis of the lungs in different stages. One to three grammes of the tincture were given daily in doses of 3/10 to 6/10 of a gramme. Dr. Schœngut found the tincture to act as an emetic in doses of 1 to 2 grammes. No styptic or other action on the digestive organs was observed, and no benefit was derived from it in the case of dysentery. He says: "Further experiments in this direction were suspended, and the application of the remedy was confined to diseases of the air passages. In such cases Naregamia has proved to be an excellent expectorant, and especially in cases where, with a limited amount of secretion in the bronchi, a disposition existed to extreme coughing, but where there was the presence of a tough and tenacious sputum which embarrassed the elimination of this undesirable factor. In one case of bronchial catarrh, which from time to time betrayed asthmatic symptoms, Naregamia rendered great service. In a number of cases of heart difficulty, comprising two of fatty degeneration of the heart in which catarrh of the air passages existed, Naregamia proved itself very serviceable. In the case of one patient with fatty heart, after several days' use of Naregamia the objective symptoms of catarrh disappeared, the rasping diminished materially, and although the quantity of the sputum at first increased, it finally almost ceased.

Dr. Schœngut also states that the tincture of Naregamia has a decidedly beneficial action in cases of pulmonary emphysema, and that it seemed to aid the expectoration in pneumonia during the period of re-solution where the râles were prominent and frequent. In the case of patients affected with dyspnœa, he found that the breathing became less difficult under its influence, but the effects seemed to be due to an increased freedom of expectoration and the consequent removal of accumulated secretions from the lungs, an opinion which agrees with the results of experiments on animals by Prof. von Basch, showing that it has no direct action on the respiratory centres.

No special influence on the circulation has been observed under the influence of Naregamia, only a short and irregular increase of pressure being noted after large doses reaching up to 5 grammes.

Naregamia does not exert any perceptible effect upon the digestive organs, and no toxic properties reside in the remedy.

SAPINDACEÆ.

Sapindus Honey.

(*Letter to the Honorary Secretary, Bombay Natural History Society.*)

I am sending you a box of dead bees I picked up under a tree now in flower in the gardens, *Sapindus emarginatus*. The tree begins to flower about the middle of October, and bears a profusion of small, whitish, inodorous blossoms which attract the bees. It seems very strange that insects possessing such a wonderful instinct should drink the nectar from the flower and get killed in this way, for I found them dead in thousands under the tree. The effect produced appears to be that of a powerful purgative, and there are now numbers of bees buzzing about on the ground unable to fly. (*Thos. H. Storey, Oodeypore, December,* 1890.)

The bees sent were *Apis indica*. It appears from this letter that the nectar in the flowers of the Soap-nut tree contains *saponin*, the active principle of the plant. The fact here recorded has not escaped the attention of the Hindus, as Sanskrit writers mention a plant or flower growing in Malwa which they call Bhramara-mari, Bhringamari, or Bhramarari, *i.e.*, "bee-killing."

Schleichera trijuga, *Willd.*

The seed-oil of this tree, which is known in the Sunda Islands under the name "Macassar oil," and enjoys a great reputation as a hair dressing and means of removing scurf and eczema, has been submitted to examination by Messrs. Thümmel and Kwasnic (*Pharm. Zeit.*, May 20, p. 314). It was found that the seeds, which contained no starch grains, yielded to petroleum ether 68 per cent. of fixed oil, but from the seeds freed from epidermis only 45·8 per cent. was obtained by pressure. The oil was in both cases of the consistence of butter, yellow, mild in taste, and with an odour of bitter almonds. It melted at 21° to 22° C., but after long standing the more solid glycerides separated, melting first at 28° and appearing under the microscope as fine needles. The fatty acids, with the exception of 3·14 per cent. of free oleic acid, were present as glycerides. Of those in combination 70 per cent. consisted of oleic acid, and of the solid fatty acids 5 per cent. was palmitic acid and 25 per cent. arachic acid, the characteristic acid of the groundnut. Lauric acid was not present, and of the volatile fat acids only acetic acid

and no butyric acid could be detected. Hydrocyanic acid was found in the oil and in the seeds, being determined as 0·03 per cent. in the former and 0·62 per cent. in the latter. No amygdalin could be detected in the seeds, but hydrocyanic acid, benzaldehyde and grape sugar, possibly the decomposition products of it, were found. A small quantity of cane-sugar was also separated in the crystallized form (*Pharm. Journ.*, May 30th, 1891).

Saponin.

The varying statements made by different authors in respect to saponin have induced Dr. Hesse to attempt to ascertain whether the substances described in recent years under that name are identical; and, if so, by what empirical formula saponin would be best represented (*Annalen*, cclxi., 371). The first question he answers in the affirmative, having arrived at the conclusion that pure saponin from quillaia bark is identical with that obtained from various caryophyllaceous plants, and with senegin. As to the second, Dr. Hesse favours the formula $C^{32}H^{52}O^{12}$, assuming the correctness of the formula attributed by Rochleder to sapogenol, the decomposition product, together with three molecules of glucose, of saponin, and that the reaction goes on in the normal way, one molecule of water being taken up for each molecule of glucose split off. The successive decompositions effected by acids may then be represented as follows:—

$$2\,C^{32}H^{52}O^{17} + 6\,H^2O = 2\,C^{14}H^{22}O^2 + 6\,C^6H^{12}O^6.$$

Saponin. Sapogenol.

$$2\,C^{32}H^{52}O^{17} + 5\,H^2O = C^{34}H^{54}O^9 + 5\,C^6H^{12}O^6.$$

Sapogenin.

$$2\,C^{32}H^{52}O^{17} + 5\,H^2O = C^{40}H^{66}O^{16} + 4\,C^6H^{12}O^6.$$

Saponetin.

$$2\,C^{32}H^{52}O^{17} + 4\,H^2O = 2\,C^{20}H^{32}O^7 + 4\,C^6H^{12}O^6.$$

Saporetin.

(*Pharm. Journ.*, May 2nd, 1891.)

R. Kobert considers that there are a series of saponins of the general formula $C^nH^{2n-8}O^{10}$, several of which are known. Saponins of the same formula and of the same chemical properties appear to have different physiological characteristics, and show great differences in their poisonous action. The sapotoxin of the *Agrostemma Githargo* (corn cockle), one of these substances, is absorbed both by

subcutaneous tissues and by the intestinal canal, and thus acts as a dangerous poison. It is recommended that, before using this seed as food, the shell and embryo should be separated. (*Chem. Centr.*, 1891, ii., 176.)

ANACARDIACEÆ.

Mango Kernels.

Hindu doctors consider the kernels of the unripe Mango fruit to be very astringent, much more so than the kernels of the ripe fruits. Mohideen Sheriff and P. S. Mootoosawmy speak highly of the powdered kernels as a remedy for diarrhœa in place of chalk powder. In times of scarcity the boiled seeds have been used by the natives as a food. An analysis is here given of the kernels of unripe and ripe Mango fruits:—

	Unripe.	Ripe.
Fat...	14·28	14·75
Tannin	8·97	8·45
Sugar and Gum	4·90	6·00
Ash	1·98	2·32
Moisture	11·22	11·28
Residue	58·65	57·20
	100·00	100·00

The residue consisted mostly of starch. The fat, after washing with alcohol, melted at 34° and became solid again at 30°. (*D.H.*)

Anacardic Acid as Hair Dye.

The pigmentary properties of the viscous liquid secreted under the pericarp of the cashew-nut (*Anacardium occidentale*) has long been known, and the liquid has been stated to yield a good indelible stamping ink. According to Herr Gawalowski (*Zeit. öst Apot.-Ver.*, Sept. 10, p. 485), the ammonium salt of anacardic acid ($C^{22}H^{32}O^{31}$), one of the constituents of the liquid, can be advantageously used as a means of darkening the hair. For this purpose the hair is first moistened with an aqueous solution of the salt and afterwards combed with a comb that has been dipped in a solution of ferrous sulphate, or the ammonium anacardate may be applied in a pomade or oil, and instead of the solution of ferrous sulphate an oleate of iron may be employed. It is stated that after a short exposure to the air the hair

so treated assumes a more or less dark colour, which is tolerably persistent, but nothing is said as to the exact tint. It is obvious that anacardic acid used for this purpose must be quite free from the acrid cardol that accompanies it in the nut. Herr Gawalowski directs that it should be prepared by treating the residue from the evaporation of an ethereal extract of the crushed pericarp with water as long as the washings showed traces of tannic acid, then dissolving it in 15 to 20 parts of alcohol, shaking the solution vigorously with freshly precipitated lead hydrate, filtering and washing the precipitate with alcohol and decomposing the lead salt so obtained with freshly prepared sulphide of ammonium and filtering. Upon strongly cooling the filtrate, which contains the ammonium salt of anacardic acid and excess of ammonium sulphide, and treating it with sulphuric acid, the acid separates at once as a soft mass, which after being pressed between filter paper is dissolved in ammonia and then remains soluble in water. According to Dymock (*Veg. Mat. Med. W. Ind.*, p. 199), a tar obtained in roasting the nuts, and largely used in India for tarring wood, contains about 90 per cent. of anacardic acid and 10 per cent. of cardol. (*Pharm. Journ.*, Oct. 3rd, 1891.)

LEGUMINOSÆ.

A description of the preparation of Catechu or Cutch.

The merchants of Nasik, Gangapur, and other towns engage the services of the *Kátoris** for the purpose of manufacturing Catechu. It is usual with these merchants to descend into the Concan at the termination of the rains. They enter into an arrangement with several of the chief Naiks to proceed with them for the purpose of preparing the required quantity of Catechu. As the Kátoris are generally in debt to the grain-dealers of the different villages, near which they reside, the traders adjust matters with the grain-dealers by paying part, and becoming responsible for the balance of the debt, on the return of the Kátori to his old residence. The trader being joined by the Kátoris, the latter select a spot where the Khair trees (*Acacia Catechu*) are numerous. The merchant then begins to erect an extensive shed, but as he has only one or two servants and three or four matchlock men with him, he employs the Kátoris to build it.

* कातोडी or कातकरी the name of a jungle tribe in Western India, whose principal occupation is the collection of काथ or Catechu.

These sheds often cover one or two begahs of ground. In the centre a temporary dwelling is built, in which the merchant resides and lodges his supply of stores for the consumption of the Kátoris and his own establishment. The following are generally the articles in store: Rice, *náchni*, *urid*, onions, garlic, pepper, salt, turmeric, cocoanuts, cumin, asafœtida, salt-fish, ghi, oil, tobacco, steel, arrack, and various sorts of coarse cloths. These things are disposed of to the Kátoris at from 50 to 75 per cent. above their value in the neighbouring markets.

The Kátoris erect their *bhoongas* or huts around the merchant's shed, and in front of their hut they prepare the *tároo* or fire-place. They form the fire-place by digging a trench four or five cubits in length and one in breadth, which they cover at the top and leave the ends open to admit the air to pass freely through. In the top there are twelve small round holes to receive an equal number of pots.

Before they commence the operation of cutting any billets of wood, they perform certain propitiatory rites, by worshipping one of the Khair trees. Having procured a cocoanut, some red pigment, and a little frankincense, they select a tree for their purpose, rub the red pigment on the trunk near the root, burn the frankincense in front of it, and then break the nut; after which they join their hands in a supplicatory position, and address themselves to the tree, asking it to bless their undertaking, and to allow them to prepare abundance of good catechu. Having constituted the tree by this ceremony, a subordinate deity, which they term *Rán Sheo Wária*, they divide the consecrated cocoanut among those present. Each family possessing a fire-place performs a similar ceremony. They make one or two incisions in the trunk of the tree during these rites, but will not cut it down at the time, although these trees are sometimes cut down at a subsequent period.

The following day the Kátoris proceed into the jungle and examine the Khair trees. They, in the first instance, strike two or three blows with an axe deep into the trunk of a tree to obtain a chip from near the centre, and if, upon examination, it appears to have attained maturity, that is, if it is of a red colour (termed by them márhi), and there appears a white crust formed by the inspissated juice, they are satisfied the tree is a valuable one and they cut it down. These people have a superstitious dread of bad luck attending their operations, and they object to a person speaking while a tree,

which they are cutting, is in the act of falling. The branches, bark, and the white portion of the wood are cut away when the tree has been felled, and it is then taken home. The length varies from four to six feet, and as the wood is extremely hard, the cutting of one billet is considered sufficient labour for the day. The next day, early in the morning, they cut these billets into chips; however, they are careful not to cut more at one time than may be required for the boiling operations of the day, as they think the chips would be too dry on the second day. To enable them more conveniently to cut these hard billets into chips, they drive three pieces of timber, each having forked branches, of different lengths, firmly into the ground about half a pace distant from each other, and the lowest being on a level with the earth. The billet is placed in a sloping position in the forks, and lies quite secure to be cut. The chips are heaped near the fire-place, after which the men take their breakfast, and then proceed to the jungle. The labour attending the boiling process always devolves on the females: the Kátori's wife or wives (for they sometimes have two or three), when she has finished her own breakfast, kindles the fire in the *tároo*, and then puts two handfuls of chips, neither more nor less, into ten of the pots, leaving the one at each end empty; water is poured in until it rises four fingers' breadth above the chips; this is ascertained by means of a small stick marked like a scale, the lines being distant from each other a finger's breadth.

It has been mentioned that there are twelve holes in each fire-place to hold that number of pots, but should the persons composing the family be sickly or old, they will most likely only use six pots; each of these pots will contain about three quarts of liquid. The pots at each end are only used during the second and third stages of the process. When the liquid has been well boiled and evaporated to a finger's breadth under the surface of the chips, they take the pots successively off the fire, and pour the liquid into one of the empty ones; after it has been well boiled in this, they apply the scale, and, if it is ready, they transfer it to the other empty pot. It is boiled down in this pot till it has attained what they consider the requisite degree of consistency, and then emptied into a trough made of the Pangara tree (*Erythrina indica*), as the timber is soft and readily absorbs water. The women now fill the pots with fresh chips, and the boiling process is thus continued until evening.

Should the liquid in any of the pots, during the boiling process, take a longer time than usual to thicken, some of it is taken out and put into one of those pots in which the chips remain and which had just been strained. Whenever they find the liquid overflow the pot from excessive ebullition, they sprinkle a little bran on it to make it subside.

When the men return home in the evening, each with his billet of wood, they examine the liquid deposited in the *âul* or trough, and, for the purpose of drying the substance and rendering it more adhesive, they use a piece of old *kamli* (country blanket), with which they keep stirring the liquid for two or three hours. They use the *kamli*, as the kât (catechu) does not adhere to it, and it is left exposed during the night that it may cool and become firm. If after the usual time they find the *kát* continues rather moist, and that it does not appear to possess a sufficiently adhesive quality, they bury it in the earth for three or four days, after which it becomes dark and hard, but the people never eat kât of this description; it is used by masons who mix it with lime.

By dawn in the morning the females are at work again; they take the kát out of the troughs in masses, and place it in baskets, to permit any remaining liquid to run off more freely, and at the expiration of three or four hours, they take the baskets to the merchant. Here they divide it into small lumps about the size of a fig. They give ten of these lumps for a *dhabbu* (half anna). They will sometimes manufacture a sufficient quantity to allow of their disposing of the value of eight or ten *dhabbus* in one day.

When the Kátoris deliver the fresh kát to the merchant, it is placed on the ground in the shade to dry, with a quantity of small chips previously scattered over the place, to prevent the earth adhering to the kát. It takes three or four days to harden; during this time, each of the little lumps is turned over once a day, and gently pressed with the hand to accelerate the drying process. The kát must always be dried in the shade, for if exposed to the heat of the sun it would dissolve and turn black.

The Kátoris are paid for the greater part in such necessaries as they may be in want of, and whatever balance remains is credited by the merchant to liquidate the sum due to the village grain-dealers for giving the Kátoris permission to quit their villages.

The Kátoris thus employed are not permitted to sell kát to other persons, and the merchant, to guard against any roguery on their part, has their huts searched daily.

The heat in the months of April and May puts a stop to the manufacture, as the kát will not thicken and dry when the atmosphere is very warm.

When the whole supply of kát has been dried by the merchant's people, it is piled into long heaps or ridges, and previous to its being removed from the jungle to his own house, he deems it necessary to propitiate the goddess Bhaváni. Accordingly, a coarse green *sárhi*, a *choli*, some glass bangles, a small-toothed comb, and a string of beads are placed on one of the heaps of kát; then some turmeric, red pigment, a casket or small box and comb (करंडा फणी), red lead, a cocoanut, and frankincense are placed near the *sárhi*, after which a sheep and fowl are sacrificed at the shrine.

It is said that the merchant reckons that he receives about ten seers* of the kát for the rupee. (*Major A. Mackintosh, Trans. Bom. Geograph. Soc.*, i., p. 331, 1838.)

Cæsalpinia Sappan.

Schreder, in the *Berichte der Deutschen Chemischen Gesellschaft*, 1872, 512, and 1879, 506, has shown that *Sappanin*, the crystalline colouring matter of Sappan-wood, is *not* identical with Brasilin.

Alhagi camelorum.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 8) says:—"After all other shrubs and plants have dried up owing to the autumnal hot winds, this still remains of a vivid green, and is eagerly sought for as fodder by camels, donkeys, and goats. During certain seasons, and in special districts, when its fruit is beginning to ripen, the whole shrub becomes covered with tears of glass-like beads, the largest the size of a pea; this is the Manna produced on this shrub, called in these parts *tar-anjabin*, which is very extensively collected, both for local consumption and exportation."

* The full seer of eighty rupees' weight, 2 lbs.

The ground-nut oil trade in Pondicherry.

The ground-nut oil trade of Pondicherry has increased enormously during the last few years: twenty years ago the total quantity exported amounted to only 1,403 casks, the whole of which was taken by Mauritius and Réunion; during the twelve months ending 31st December 1890, the total shipment rose to 18,485 casks, 7,503 being consigned to Rangoon and Moulmein; large quantities were also taken by Calcutta, Coconada, Singapore, and Penang. The oil trade with Burmah, which scarcely existed eight years ago, has now risen to a steady demand for about 700 candies a month. The oil is put up in English beer hogsheads holding 440 lbs. each, and in Cochin oil casks containing 550 lbs. each. The tabulated tables given below show the total shipments, and the highest, lowest, and average prices for certain given periods. The ground-nut kernels are crushed exclusively by the ancient wooden presses of exactly the same pattern which have been used for several centuries; about 1,200 of these mills are employed in crushing the kernels—800 at Vilvanur, a village in the Villapuram taluq, eighteen miles west of Pondicherry, and 400 in Pondicherry and the neighbouring communes: the trade is entirely in the hands of native operators, who buy and crush the nuts, and ship and sell the oil without the intervention of any European agency. A company was started at Pondicherry a few years back for erecting and working a *huilerie* to be worked by steam power, and in due time the mill commenced crushing, but the results were unfavourable, the cost of working and of the raw material being largely in excess of the value of the oil produced; after persevering for upwards of two years, company No. 1 decided to close up the concern by liquidation; but for some time no purchaser could be found, and it was therefore resolved to sell off the property by public auction, but "bidders," were not forthcoming, and as a last expedient the factory *en bloc* was transferred to a small party composed of original shareholders, for a mere song. This company No. 2 soon came to grief, and finding the losses on working to be more than they cared to bear, the mill was again closed and advertised for sale. After a considerable delay a Calcutta firm bought the property, and having made various improvements in the machinery, set vigorously to work at crushing, but with no better result than that obtained by companies Nos. 1 and 2; and the factory was again closed for the

third time in about as many years, and company No. 3 retired. And now the end of Pondicherry *huilerie* has come, and the machinery is being taken down and conveyed to Bangalore, where it is to be re-erected and worked for crushing ground-nut kernels: Bangalore has already one steam oil mill, and it has to be seen whether two can be made to pay. The complete failure of the several attempts made to work the Pondicherry factory is attributed to various causes, of which the following are the chief:—*First*, the inefficiency of the machinery generally, and of the engine and boiler in particular, which caused an extravagant consumption of fuel to obtain minimum results; *second*, the absence of a practical engineer thoroughly acquainted with oil crushing machinery; *third*, the want of a sufficient working capital so as to purchase the raw material, fuel, &c., in advance, when prices were low; and *fourth*, the want of unanimity among the owners. The results, however, were so far valuable, that they demonstrated the fact that the crushing of ground-nut kernels by improved steam machinery of a modern type would yield large profits, provided it was efficiently supervised and economically worked: it was found that the outturn from steam crushing was nearly 4 per cent. greater than what was obtained from native presses, while the quality of the oil was so much superior that it fetched fully 3½ per cent. more in the Burmah, Singapore, and Indian markets. The export of the ground-nut oil trade developed only about 1875, when 9,150 casks were shipped, including 1,581 to Bordeaux, 1,036 to Marseilles, 572 to London, 207 to Havre, and 200 to Martinique; but the trade with Europe stopped when Marseilles began crushing on a large scale, and during the last twelve years there have been no transactions. The use of the oil for cuisine purposes is extending every year, especially among all classes of Indians, and particularly with Indian emigrants working in foreign countries. The 12,000 casks shipped yearly to Burmah and Mauritius are consumed chiefly by Indians, and it is likely that Natal and other places where Indian labour is employed will presently become large consumers. Ground-nut oil is not much used by Europeans, as the taste of the kernel is rather strong, unless properly manipulated; many native cooks, however, clarify it so thoroughly that it is rendered tasteless, and equal, if not superior, to ordinary olive and salad oils. The process is a very simple one, but great care and judgment are necessary to insure

success: if the clarifying secret were better known, the oil would, no doubt, to a large extent, take the place of *ghee*; it is much better for cooking purposes, far cheaper, and more readily transported, while it cannot be easily adulterated. The consumption of the *huile d'arachides* seems to follow on the track of Indian emigrants: in 1880 there were but very few Indians settled in Singapore, Penang, &c., and in that year the export of ground-nut oil amounted to only 10 casks; in 1890 the shipments to these two ports amounted approximatively to 1,800 candies. The future of the export oil trade seems to wear a decidedly bright appearance, and there is no apparent reason why the development of the last few years should not continue at the same ratio for at least some years to come. The value of the traffic to Pondicherry is very great: besides the labour required to work the native mills, employment is given to a large number of coopers and others in preparing and shipping the casks. The following statement shows the total number of casks exported for the periods named below:—

Number of casks	1885.	1886.	1887.	1888.	1889	1890.
exported	10,403	10,256	17,727	16,093	19,365	18,485

It will be seen by the above that the shipments during the last four years have not materially changed; the period of 1889 was exceptional, the ground-nut crop being unusually large, and the prices generally low.

The statement given below exhibits the highest, lowest, and average rates, per French candy of 529 lbs. English, during the several years mentioned:—

	1875.		1880.		1885.		1890.	
	Rs.	a.	Rs.	a.	Rs.	a.	Rs.	a.
Highest quotations per candy ...	49	0	70	0	67	0	86	0
Lowest per candy	32	12	51	14	52	0	55	0
Average do.	40	3	59	8	55	14	62	4

The exceptional low prices for 1875 are accounted for by the unexpected heavy crop of kernels, which was greatly in excess of the foreign demand, which caused the rates to rule low, and to offer unusually good advantages to local crushers. (*Times of India*, March 31st, 1891.)

Pondicherry, 27*th April* 1893.—The number of casks exported in 1892 was the lowest since 1887, in which year the purchases for

Upper Burma first commenced. The high price of kernels throughout the season was no doubt the main cause of the falling off, but it is noticeable that there was a considerable decrease in 1891, when both nuts and oil were comparatively cheap. The average number of casks shipped yearly from 1887 to 1890, both inclusive, was 18,068, as compared with 15,390 for 1891 and 1892. The average quotations of the oil, for the same periods, were Rs. 59 and Rs. 70, respectively, per French candy of 529 lbs. The trade with Calcutta, the Straits and Coast ports shows no signs of improvement, while Mauritius and Bourbon figures remain pretty much the same as in former years. The ground-nut oil trade—at least so far as its consumption is concerned—is an enigma. In Bourbon and Penang, where Indians monopolise the labour markets, very little of this generally indispensable culinary article is used, while in both Upper and Lower Burma the consumption is enormous, although the Indian population is, comparatively, very much less than it is in the former colonies. We must assume that the native Burmese is the better customer of the two. The price of the oil has risen in greater proportion than that of ground-nuts. In 1875 the highest quotation was Rs. 49 per candy and the lowest Rs. 32-12-0, when in 1892 the rates were Rs. 86-8-0 and Rs. 69, respectively. As in the case of the kernels—which are grown almost exclusively on British soil—the great bulk of the ground-nut oil shipped at Pondicherry is manufactured in English territory, the village of Valavanur, a station on the Pondicherry-Villapuram Railway, supplying the greater part. The trade is entirely in the hands of native operators. The approximate value of last year's shipments may be taken at 11¼ lakhs of rupees. For the current year the prospects are, so far, encouraging. In spite of the high prices of the kernels, the shipments from the 1st January to the 31st March amounted to 3,928 casks, as compared with an average of 3,888 casks for the same period during the preceding four years. The average price was Rs. 73,140 per candy, the highest Rs. 79-8-0, and the lowest Rs. 65-8-0, against Rs. 67-5-0, Rs. 83-8-0, and Rs. 58-12-0, respectively. (*Madras Mail.*)

Crotalaria paniculata.

Dr. Mootoosawmy, in March 1890, sent a specimen of this plant for identification. It is used as a fish poison in Tanjore and other places in Southern India, and is known by the Tamil name

Valithe-pundu. An alcoholic extract of the plant had a strong odour of henbane, and contained a soft resin, a tannin, and an alkaloid, the latter being the active principle. (*D.II.*)

Crotalaria retusa, *Linn. Bot. Mag., t.* 2561 ; *Rheede, Hort. Mall. ix., t.* 25.

Greshoff (*Med. uit. S'lands Plant*, vii., p. 31) has shown that the leaves of this common plant, the Bil-jhanjhan of Bengal, the Ghágri of Bombay, and Potu-galli-gista of Southern India, contain a considerable quantity of *indican* ; and that the seeds contain an alkaloid which is a strong poison, and is probably closely related to the poisonous alkaloids of Cytisus, Ulex, Spartium, and Lupinus.

The same base was found in larger quantity in the seeds of *C. striata*, DC. *Bot. Mag., t.* 3200 ; *Reich. Icon. Exot., t.* 232.

Millettia atropurpurea, *Bent. Wall. Pl. As. Rar., t.* 78.

Greshoff (*Med. uit. S'lands Plant.*, vii., p. 33) has shown that the seeds contain a glucoside similar to, if not identical with, *saponin.* The plant is employed as a fish poison in the Dutch East Indies; it is also a native of Martaban, Tenasserim, Malacca, and Penang.

Pithecolobium bigeminum, *Mart.*

According to Greshoff, the bark contains 0·8 per cent. of a non-volatile, amorphous alkaloid, which forms crystalline salts, and separates as a heavy, yellow oil on the addition of alkalies to solutions of the latter. With 100 parts of water, it forms a turbid liquid, which on warming assumes the appearance of milk, but becomes clear on the addition of an acid. The solutions have a burning taste, and give the usual alkaloid reactions. It has a strong corrosive action on the skin, and is fatal to fish in a dilution of 1 : 400,000. The same compound appears also to occur in *P. Saman*, Benth. (*Meded. uit S'lands Plant.*, vii., p. 38.)

Derris elliptica, *Benth. Wight, Ic. t.* 420.

The roots of this handsome climbing shrub, according to the Kew Report of 1877, afford a useful insecticide for agricultural purposes, and are also used to kill fish. The Malays are said to use the bark as one of the ingredients of their arrow poison.

According to Greshoff (*Meded. uit. S'lands Plant.*, vii., p. 12) it has a powerfully poisonous action on fish, a decoction of the roots being fatal even when diluted with 300,000 parts of water. The only active constituent isolated is a resinous substance termed *derrid*, which does not contain nitrogen, and is not a glucoside; it readily dissolves in alcohol, ether, chloroform, and amyl alcohol, but is very sparingly soluble in water and potash solution. On fusion with potash, it yields salicylic and protocatechuic acids. It occurs almost entirely in the cortex of the root, but has not yet been obtained pure. Its alcoholic solution has a slightly acid reaction, and a sharp aromatic taste, causing a partial insensibility of the tongue, which remains for hours. A solution of 1 part in 5 millions is almost instantly fatal to fish. A very similar compound is found in the seeds of *Pachyrhizus angulatus*, Rich., a decoction of which is quickly fatal in a dilution of 1:125,000. It is probably identical with derrid, but until this has been experimentally proved it may be distinguished as *Pachyrhizid*. It is very readily prepared from *Pachyrhizus*, which occurs in all tropical countries, as the tannin compounds, usually so difficult to separate, are not found in this plant. The seeds also contain a non-poisonous, crystalline compound, which is readily soluble in alcohol, and has at 30° the consistence of butter.

Sophora tomentosa, *Linn.*

The plant formerly renowned as a medicine ("*Anticholerica Rumphii*") contains a poisonous alkaloid, soluble in ether, which is contained in largest quantity in the seeds. A small quantity of this substance, received by Professor Plugge as a thick red-brown fluid, when tested physiologically, gave results indicating the probability that it is identical with cytisine, the alkaloid of laburnum seeds, and this probability was strengthened by the results of such chemical and spectroscopical tests as were possible with the small quantity of material available (*Archiv. d. Pharm.*, ccxxix., 561). Alkaloids have previously been found in *S. speciosa* and *S. angustifolia*, but have not been closely investigated.

Abrin.

P. Ehrlich (*Deutsche Med. Wohenschrift*, 1891, No. 14) compares the toxic properties of Abrin with those of Ricin. Injected hypodermically, he finds abrin (Merck's) to be only half as poisonous as ricin; taken internally, it is still less active.

Subcutaneous injections in mice seldom produce the necrosis so commonly observed when ricin is injected, but invariably cause epilation at the seat of the injection. On the other hand, the action of abrin upon the conjunctiva is much more powerful than that of ricin. Ehrlich has succeeded in producing an immunity to the action of abrin similar to that obtained with ricín (*cf.* Vol. III., p. 305). Animals thus rendered refractory present a general and local immunity to the action of the poison; they bear without injury doses four times as large as those which would prove fatal to an unprotected animal, whether administered internally or injected beneath the skin. Absolute immunity of the conjunctiva to the action of abrin may be obtained by its internal administration for several weeks. From these facts the author concludes that a substance, which he calls anti-abrin, is developed in the blood which completely counteracts the action of the poison.

Immunity to the action of abrin affords no protection against the action of ricin, nor does the administration of ricin lessen the activity of abrin; a rabbit whose conjunctiva had been rendered insusceptible to the application of solid ricin suffered from an intense conjunctivitis when a solution of 1 : 10000 of abrin was applied to the part.

ROSACEÆ.

Otto of Roses.

The results of the investigations on Rose Oil, which have been carried on for a long time in the Pharmaceutical Institute of Breslau University, have been published by U. Eckart (*Archiv. der Pharmacie*, 229 [1891], 355). A body $C^{10}H^{18}O$, which is called "Rhodinol," forms the chief constituent of both German and Turkish otto; it boils at 216°—217°, and shows all the reactions of an alcohol. With acetic or benzoic anhydride it forms esters, which, however, during distillation, dissociate again into their constituents. By treatment with halogen hydro-acids, Rhodinol chloride $C^{10}H^{17}Cl$, Rhodinol iodide $C^{10}H^{17}I$, and so on, are obtained. Oxidation with potassium bichromate and sulphuric acid converts Rhodinol into an aldehyde, which the author calls "Rhodinal" and which is believed to be identical with Citral. By phosphoric anhydride Rhodinal is transformed in Dipentene in abstracting a molecule of water. (*Ber. von Schimmel & Co.*, Oct., 1891.)

COMBRETACEÆ.

Myrobalans.

G. Zoelfell (*Arch. der Pharm.*, 1891, 123—160) states that the tannin of myrobalans is a mixture of two tannins, one of which is the glucoside of gallic acid, yielding upon hydrolysis gallic acid and sugar (dextrose); the other tannin present is a tannic acid proper of the formula $C^{10}H^{10}O^{10}$, which at 100° C. loses two molecules of water. The anhydrous acid $C^{14}H^{6}O^{8}$ is called ellagic acid (the formula of which is generally given as $C^{14}H^{8}O^{9}$); the hydrated acid $C^{10}H^{14}O^{10}$ is called ellaggenic acid; the latter forms a penta-acetyl derivative, indicating five and four hydroxyl groups, respectively, in the acids. The tannins were separated by fractional precipitation with lead acetate, subsequently purified by precipitation with sodium chloride and solution in acetic ether.

Terminalia chebula.

Mr. A. Campbell Stark submitted a paper on the "Preliminary Proximate Analysis of a sample of commercial Myrobalans" to the Pharmaceutical Conference, August, 1892.

A finely powdered and well-mixed sample yielded 7·05 per cent. of moisture and 2·3 per cent. of ash—

Petroleum Ether Extract ...	Free fatty acid ...	·482
	Wax	·428
Ethereal Extract	Gallic acid	3·02
	Tannin	1·80
	Green resin	·54
	Brown resin	·97
Alcoholic Extract	Tannin	18·80
	Bitter principle ...	1·9
	Glucose	1·13
	Saccharose	1·25
	Phlobaphane... ...	·86
	Colouring matter ...	·35
	Pale green substance ...	·71
Aqueous Extract		5·10

The soft green resin found in the ethereal extract is presumably the "Myrobalamine" of Dr. Apery. The tannin was estimated in the aqueous solution of the alcoholic extract by means of copper acetate,

including that also found in the ether extract: it amounted to 20·6 per cent., a lower percentage than that quoted by other investigators, who give the average of tannin in myrobalan from 20 to 40 per cent.

Terminalia belerica, *Roxb.*

We have made the following experiments with the seeds of the large-fruited variety of this tree (see Vol. II., p. 5, *et seq.*) :—9·5 grams of the kernels, equal to 22 in number, pulped with raw meat were eaten by a fasting cat at 11-40 A.M. At 2·30 P.M. the animal vomited several times, ejecting a number of worms and some fluid, but no meat. 4 P.M. vomited bile-stained, frothy fluid, looks somewhat distressed. No other symptoms were noticed, and on the following morning the cat was in its normal state.

Our experiments thus appear to indicate the absence of any narcotic principle, but a substance which possesses emetic properties is probably present.

MYRTACEÆ.

Clove Culture in Zanzibar.*

Zanzibar is noted for being the principal source of the world's supply of cloves, and a report on the cultivation of this article of domestic economy may prove of interest.

When speaking of Zanzibar, we include the islands of Zanzibar and Pemba, three-fourths of the entire crop of cloves being produced in Pemba. Those grown on the island of Zanzibar are reckoned of superior quality and command the better price, but this is probably due to the fact that the owners reside here, and can thus give their affairs the benefit of direct supervision.

Certainly the conditions for their successful cultivation are most favourable at Pemba, where the rainfall exceeds that of Zanzibar, but the management being left to careless overseers, the result is the cloves are imperfectly cured and (but little care being observed in handling) are frequently marketed in an inferior condition.

The clove tree was first introduced into this country by the then Sultan, Seyed Said bin Sultan, about the year 1830, since which time its cultivation has gradually extended, until it is now the chief industry of the islands.

* Report of Consul Pratt. Reprinted from the *Oil, Paint, and Drug Reporter*.

The industry received a check in 1872, the date of the great hurricane. At least nine-tenths of the trees were destroyed at that time, so the larger part of those now standing are of new growth.

A peculiarity of the clove tree is that every part is aromatic, but the greatest strength is found in the bud, which is the "clove" of commerce. The finest quality of cloves are dark brown in colour, with full, perfect heads, free from moisture.

In the cultivation of the clove, the first thing to be done is the starting of the shoot. The seeds are planted in long trenches and are kept well watered until after sprouting. In the course of forty days the shoots appear above ground. They are carefully watered and looked after for the space of two years, when they should be about 3 feet in height. They are then transplanted, being set about 30 feet apart, and are kept watered till they become well rooted. From this time on the young trees require only ordinary care, though the best results are obtained when the ground about the trees is well worked over and kept free from weeds.

The growth of the tree is very slow, and five or six years are required for it to come into bearing, at which time it is about the size of an ordinary pear-tree, and is usually very shapely. It is a pretty sight to see a young plantation just coming into bearing. The leaves, of various shades of green tinged with red, serve to set off the clusters of dull-red clove buds.

As soon as the buds are fully formed and assume this reddish colour, the harvesting commences, and is prosecuted for fully six months at intervals, since the buds do not form simultaneously, but at odd times throughout the whole period. The limbs of the tree being very brittle, a peculiar four-sided ladder is brought into requisition, and the harvesting proceeds apace.

As fast as collected, the buds are spread out in the sun, until they assume a brownish colour, when they are put in the storehouse and are ready for market.

A ten-year-old plantation should produce an average of 20 pounds of cloves to a tree. Trees of twenty years frequently produce upwards of 100 pounds each.

The present season, commencing with July, 1889, is very favourable, and the crop will exceed that of any previous season. It will, in all probability, amount to 13,000,000 pounds, averaging a local value of 10 cents per pound.

The Sultan derives no inconsiderable portion of his revenue from this source, since the duty is levied at 30 per cent. *ad valorem*, thus placing to the Sultan's credit for the present year nearly, if not quite, $400,000.

Besides the clove buds, the stems are also gathered, and form an article of commerce, commanding about one-fifth of the price of cloves and having about the same percentage of strength. To this circumstance is due the fact that ground clove can frequently be purchased in the market at a lower price than whole cloves.

For the past fifteen years the cultivation of cloves has been the chief occupation of the Arab planters, and has always netted good returns. It seems probable that it will continue to be a profitable crop, since the consumption of the article appears to keep pace with the inevitable increase of production.

Up to the present time the plantations have been worked with slave labour at comparatively small expense; but with stoppage of slave supplies from the mainland, great difficulty will be experienced by the planters during harvest time. One result will be an increase in expenses; but what the planters have most to fear is that the curtailment of the labour-supply will entail a direct loss by rendering it impossible to harvest the crop until after it has blossomed, when it would be unfit for the uses of commerce.

Oil of Cloves.

The value of this oil depending upon the quantity of eugenol present, H. Thoms proposes the following method of assay, depending upon the formation of benzoyl-eugenol (see *Am. Jour. Pharm.*, 1891, 406): 5 gms. of the oil, 20 gms. solution of sodium hydrate (15 per cent.), and 6 gms. benzoyl chloride are placed in a tared beaker of 150 cc. capacity and thoroughly mixed, this causing the mixture to become quite hot; after cooling 50 cc. water are added and heat applied until the crystalline mass melts, and again allowed to become cold; the clear liquid is run through a weighed filter (dried at 101°C.), and the same operation of washing the crystals repeated twice with 50 cc. water. To remove the sesqui-terpene, which may contaminate the benzoyl-eugenol, the crystals have to be washed with alcohol; this is effected by adding to the still moist crystalline mass in the beaker 25 cc. alcohol of 90 per cent., warming until solution is effected, rotating the solution until the crystals begin to

separate again, then allowing the contents of the beaker to cool to 7° C.; transferring to the weighed filter and washing with a little 90 per cent. alcohol until the filtrate measures 25 cc.; the filter with contents is then at once transferred to the beaker, dried at 101° C. and weighed. To the weight of the benzoyl-eugenol must be added 0·550 gm., the amount soluble in 25 cc. 90 per cent. alcohol; this weight multiplied by 164 (the molecular weight of eugenol) and divided by 268 (the molecular weight of benzoyl-eugenol) gives the amount of eugenol in 5 gms. oil; for the percentage multiply again by twenty.

An examination of sixteen samples showed the eugenol to vary from 76·87 per cent. to 90·64 per cent.; the oil distilled from the stems was found (contrary to expectations) to contain a high percentage of eugenol, 83—85 per cent.; the specific gravity of the oil was not found to agree with the percentage of eugenol as the following show: 1·059 = 83·2 per cent.; 1065 = 80·89 per cent.; 1·065 = 82·77 per cent.; 1·0615 = 84·10 per cent.; 1·0655 = 90·64 per cent.; 1·061 = 81·18; this led to the belief that there must be a third constituent present in the oil, for if there were only eugenol and sesqui-terpene the specific gravity should vary in accordance with the percentage of eugenol. (*Pharm. Centralhalle*, 1891, 589. *Am. Journ. Pharm.*, Jan., 1892.)

PASSIFLOREÆ.

Carpaine, the alkaloid in the leaves of Carica Papaya.

A new alkaloid has recently been detected in papaw leaves by M. Greshoff, of the Chemico-Pharmacological Laboratory at Buitenzorg in Java. It was obtained by digesting the powdered leaves in spirit acidulated with acetic acid, removing the spirit by distillation, and treating the resulting extract with water so as to leave behind resin and chlorophyll. The aqueous solution was then shaken repeatedly with ether, and carbonate of soda was added until an alkaline reaction was evident. The precipitate thus obtained was readily soluble in ether, and on evaporation of the ether the "carpaine" was obtained in colourless rosettes of crystals to the extent of about 0·25 per cent. of the leaves employed. Although the freshly pecipitated alkaloid is readily soluble in ether, when once crystallized it redissolves but slowly, so that the crystals can be purified and rendered perfectly white by washing with a little ether, but the percentage obtained is thus reduced to 0·15 per cent. On a large scale the lime and

petroleum method gives very good results, about 0·19 per cent., and would probably be preferred on the score of expense. Comparative experiments made on the young and old leaves freed from the stalks show that the old leaves afford when dried 0·072 per cent. of the alkaloid, the young leaves 0·25 per cent., and that on an average a papaw plant can be calculated to afford 30 grams of the alkaloid per year from the leaves. The hydrochlorate of carpaine, which contains about 82 per cent. of the pure alkaloid, is freely soluble in water. As yet comparatively little is known of the physiological action of the alkaloid. It appears, however, to act more especially upon the heart, slowing its action. The lethal dose for a fowl of 500 grams weight was found to be about 200 milligrams. In a fowl of 350 grams weight no poisonous symptoms were produced with 50 milligrams of the alkaloid; with 100 milligrams symptoms of poisoning occurred in ten minutes after injection into the breast muscles, but after twenty-five minutes the animal recovered its normal condition. The bird lay on its side and breathed deeply in a jerky manner, and showed slight convulsive movement of the whole body, but no irritability was noticed. Further observations are necessary to determine the usefulness or otherwise of the alkaloid in medicine; should it prove of utility, there can be no difficulty in obtaining it in almost unlimited quantity and in a definite crystalline condition. The alkaloid is easily precipitated from its solutions by the alkaloid reagents. The most delicate reaction is with Mayer's reagent, iodoiodide of potassium, which in a solution of 1 in 300,000 gives a turbidity, and in 80,000 parts an evident precipitate; phosphomolybdate of ammonium has its limit of reaction at 1 in 75,000 parts, picric acid at 1 in 30,000, and chloride of gold at 1 in 25,000. The alkaloid has a bitter taste, which is perceptible even in a solution of 1 part in 100,000.

CUCURBITACEÆ.

Constituents of Melon Seeds.

C. Forti (*Chem. Centr.*, 1890, ii., 581) found these seeds to contain cholesterin and a dextro-rotatory carbo-hydrate apparently belonging to the galactan group.

The oil yielded by the seeds to ether amounts to 49 per cent., and is almost free from fatty acids. It contains lecithin. The phosphorus amounts to about 0·02 per cent. (*Year-Book of Pharm.* 1891, p. 194.)

UMBELLIFERÆ.

Anethum.

(*Peucedanum graveolens*, Benth.)

A distillate from Indian dill seed is reported to have shown besides a difference in the aroma, a considerable variation in chemical composition from oil distilled from German seed. From the distillate from Indian seed there was a remarkable separation of a constituent heavier than water, the nature of which has not yet been determined. The specific gravity reached 0·970, and the optical, rotation +41° 30′. German dill oil consists of limonene and carvol and has an average specific gravity of 0·910. (*Ber. von Schimmel & Co.*, Oct., 1891.)

Dorema Ammoniacum.

Under the name of بریر (bury) we have received from Afghanistan the root of this plant.

Anisun.

Under this name we have received Hemlock fruit from Afghanistan.

ARALIACEÆ.

Panax Ginseng.

Davydow (*Pharm. Zeitschr. f. Russl.*, 1890, pp. 97, 113, 130) has taken up the analysis of this root made by Garrigues (*Am. Jour. Pharm.*, 1854, p. 511). For panaquilon he uses the following process: The finely powdered root is repeatedly extracted with cold water until it shows no acid reaction. The several aqueous extracts were united and treated with animal charcoal, filtered and evaporated to dryness. The residue is dissolved in boiling 95 per cent. alcohol, filtered, and the alcohol recovered. Panaquilon remains as an amorphous, light yellow mass, easily soluble in alcohol and water, insoluble in ether, and does not contain nitrogen. Concentrated sulphuric acid gives a blood-red colour, gradually turning to a reddish violet. Panaquilon is neither an alkaloid nor a glucoside. On boiling with dilute sulphuric acid a crystalline powder, panacon, separates, which is insoluble in water and ether, but soluble in alcohol. Concentrated sulphuric acid dissolves and colours it purplish red.

Concentrated nitric acid oxidizes it to oxalic acid. Garrigues gives the following formulæ: Panaquilon $C^{24}H^{25}O^{18}$, Panacon $C^{22}H^{19}O^{3}$ $(O=8)$. (*Am. Journ. Pharm.*, July, 1890.)

RUBIACEÆ.

Randia dumetorum.

Sir J. Sawyer (*Lancet*, Mar. 21, 1891) has employed a tincture of the fruit made with spiritus etheris, B. P., as a nervine calmative and antispasmodic; the dose is from 16 to 30 minims in water, but the strength is not stated. We have already shown that the drug contains saponin and valeric acid.

Ixora parviflora.

P. S. Mootoosawmy has sent us a sample of the bark of this tree, with the remark that it is used in native medicine, mixed with a decoction of ginger, for anæmic diseases; he suspected the presence of iron in it. The bark contained a little fatty matter, tannin, red colouring matter and 11·5 per cent. of ash consisting of the usual constituents, with only a trace of ferric oxide. The decoction of the bark was of a deep red colour, which probably suggested its medicinal employment.

Note on Catechu.

In the Library of the Botanic Garden at Oxford I recently came across a book which apparently escaped the observation of the indefatigable authors of *Pharmacographia*, entitled "Ehrenfridi Hagendornii Medicinæ D. et Pract. Gorl. Tractatus Physico-Medicus de Catechu sive Terra Japonica in vulgus, sic dicta ad normam Academiæ Naturæ-Curiosorum. Jenæ, 1679." This gives very interesting particulars respecting the history, nomenclature, and physical characters of Catechu.

"De patria Catechu." The author writes:—"Si Catechu agnomen respicias, quod Japonica etiam indigitetur, facilis esset decisio, quem agnoscat *locum natalem*. In ambiguo tamen usque est, an in Japonica vel præparetur vel aliunde ad Japonenses transporteter. Ex aliis finitimis locis in *Malaccam* et Sinam exportari." The italics are mine.

"De differentiis Catechu," "Duplicis generis quod sciam, innotuit Catechu hactenus. Una magisque communis Catechu species

apparuit rubicundior, ad nigredinem veluti quandam inclinans, cum striis albicantibus, instar linearum per totum Catechu subjectum excurrentibus, itemque ponderosior compacturque. *Altera* a me visa fuit compacta, nec ita colorata, colore potius ad albedinem inclinante, porosior item, levioris ponderis, digitis quoque frangi facile terrique sustinens, nec Rae rubicundioris, ceu altera, adeo ferax."

Other differences are noted. Whether the pale variety alluded to be the cutch of North India I am unable to say. May it not be the Gambier cutch? If so, this will be a very early notice of that drug.

In another chapter of "De Electione Catechu" the writer says:—"Usus obtinuit, ut si de notis bonitatis indijudicandis medicinalibus certiores esse velimus, ad manus asservemus exemplum quoddam, ad quod tanquam ad Lydium lapidem pensiculanda pensiculemus eaque si bonitate cum examplo conveniant, retineamus sin minus, aversemur. Hinc cum duæ hactenus Catechu species sese mihi obtulerint, illam putaverim alteri preferandam, que saturatiori se commendat rubedine, quæ compactior, quæ ponderosior, quaque minus participat de lapillis, seminibus, lignis aliisque inibi interdum repiriri solitis. Quâ fini etiam apud aromatarios jam receptum est, ut integros Catechu globos prius malleo contundant, visuri, quænam sit species, ne pallidiore et viliore ob metum adulterationis, qua Japonenses ut plurimum malè audiunt, emptores defraudent.

"Sec. 2. Notari tamen expedit, suggerente id qualicunque experientiâ meâ utramque suam mavere posse laudem: *Rubicundiorem* cum opus est peculiari multaque adstrictione; *Pallidiorem* vero, ubi magis præcipitandi et absorbendi, humores vitosos intentio est, modo prius probe à lapillis et depuretur."

Section 3 is devoted to the 'Pharmaceutica'; section 4 to 'Therapeutica.'

One prescription may be quoted, for it gives an example of the early use of the word chocolat—

℞ Conserv. rosar-antiq.	... ...	℥j.
Flor borrag	... ...	℥ss.
Chocolat	... ...	ʒij.
Catechu	... ...	ʒj.

Vin. Malvat. q. s. cum $_o{}^o{}_o$ cinnam, rosar. ā. g. j. M. sic viro cuidam primario in eructatione ventriculi, quâ præmodum constictabatur. (*By G. Claridge Druce, Pharm. Journ., Jan.* 1892.)

VALERIANEÆ.

Valeriana Wallichii.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 96) states that *gur-bálchorak* is a trade name for the roots of this plant in Afghanistan. He remarks:—"A Kabul trader at Leh told me that it was the same as *gur-balchorak* in the Peshawur trade, and owing to a load of which he was once nearly driven mad in conveying it from Kabul to Peshawur, by all the cats in the country surrounding him at night, wherever he halted." Aitchison supposes the name to be a contraction of *Gurba-bálchorak*, which would signify "the cat valerian."

COMPOSITÆ.

Solidago Virga-aurea.

Dr. Mascarel is said (*La France Médicale*, Oct. 8, 1889) to have used the plant very successfully in cases of dropsy. It has long been used by country practitioners to produce diaphoresis. It grows plentifully in the Northern parts of the United States, and resembles *Sol-odora*, the "sweet-scented golden rod," or "blue-mountain tea." In administering it for cardiac dropsy, Dr. Mascarel reduces the dried plant—stems, leaves and flowers—to a coarse powder, and gives it in doses of one tablespoonful, beaten with an entire egg (yolk and white). He gives but one dose on the first day; but on each of the following days he adds a tablespoonful, until seven or eight doses are being taken during the twenty-four hours. The diuresis is said to continue until œdema permanently disappears.

Helenin in Tuberculosis.

Helenin has now for some time been before the medical public as a remedy in phthisis, but without any apparent progress in its use. Dr. T. J. Bokenham has published an account of numerous experiments made by him as to the real value of the substance, and so far as can be gathered from the account given in the *British Medical Journal* (Oct. 17, p. 838) it would appear that the crystalline bodies occurring in *Inula Helenium* are difficult to separate on a large or commercial scale, and that consequently alantic anhydride was the only substance procurable commercially for his experiments. The other crystallized bodies were, however, obtained in sufficient

quantity for laboratory experiments. These experiments showed that any of the crystalline bodies would prevent the growth of the tubercle bacillus if present in the proportion of 1 in 10,000, and in any ordinary cultivating medium for this bacillus. The effect of the administration of the alantic anhydride appeared to be to prolong life for a time in the animals experimented on, but not to prevent a fatal result. Helenin has also been lately given with good results in leucorrhœa in the dose of 2-4 centigrammes (*Rép. de Pharm.*, Oct., p. 481). (*Pharm. Journ.*, Oct. 31, 1891.)

Pluchea lanceolata.

Description.—Shrubby, hoary pubescent, with sessile, very coriaceous, oblong or oblanceolate entire leaves, one to two inches in length, having strong very oblique nerves on both surfaces. When dry, the leaves are of a pale yellowish-green. Heads of flowers in compound corymbs about the size of Groundsel, purple, involucre bracts contracted at the mouth, outer bracts obtuse, hoary. The drug has no marked taste.

Chemical composition.—The taste of these leaves is saltish and aromatic. They yield, in an air-dried state, 16·93 per cent. of mineral matter, consisting largely of alkaline chlorides, the cubical crystals of which were deposited on inspissating the alcoholic and aqueous extracts of the plant. Caoutchouc, and an organic-acid giving a green precipitate with ferric salts, were present, but no alkaloid. We have tried some experiments with preparations of Pluchea leaves, and conclude that, weight for weight, they are much weaker than senna leaves in their cathartic action.

The Existence of a Mydriatic Alkaloid in Lettuce.

The attention of the author was drawn a few months ago to the mydriatic action of an extract prepared at Hitchin from common lettuce, *Lactuca sativa*, when in flower. On examination, the mydriatic action was found to be due to an alkaloid. The extract closely resembled belladonna extract in appearance, smell, and taste; but a dose of 5 grains had been taken without injurious effects. Three other commercial extracts of lettuce were examined—namely, an extract of wild lettuce, *Lactuca virosa*, prepared according to the directions of the British Pharmacopœia, the history of which was unknown, and extracts of both the wild and the cultivated lettuce

prepared at Market Deeping, in Lincolnshire. An extract of that variety of the cultivated plant known as Cos lettuce was also examined. They all contained an alkaloid which had a very marked power of dilating the pupil of the eye. Finally, a dried specimen of wild lettuce, collected when in flower, was examined. It contained a mydriatic alkaloid.

The impure alkaloid obtained from the extract was a light brown syrup, which possessed powerful mydriatic properties. In order to purify it, it was converted into the oxalate. The alkaloid recovered from the pure oxalate, when crystallized from chloroform, closely resembled hyoscyamine, both in appearance and in melting point. The aurochloride was then produced by the usual methods, and this, after recrystallization, was obtained in the shining flat needles characteristic of the aurochloride of hyoscyamine. The estimation of the gold and the base in this compound showed that the alkaloid was one of three isomeric mydriatic alkaloids, having the formula $C^{17}H^{23}NO^{3}$, while its melting point was 159·75° (corr.), and closely corresponded with that ascribed by Ladenburg to the aurochloride of hyoscyamine. The plant does not appear to contain a second mydriatic alkaloid, although it must be remembered that only small quantities of material were operated upon.

The author has just shown that both wild and cultivated varieties of lettuce, especially when the flowering stage is reached, contain hyoscyamine, the mydriatic alkaloid occurring in *Hyoscyamus niger*, *Atropa Belladonna*, and other plants belonging to the natural order *Solanaceæ*, and it is probable that to the presence of this alkaloid the sedative and anodyne properties of extract of lettuce are due.

That this important constituent has been until now overlooked is probably due to the fact that in chemical investigations upon lettuce the dried milk sap, lactucarium, has alone been examined, although its value as a sedative and anodyne is by no means established. The author found that lactucarium of both English and German manufacture was devoid of mydriatic properties and contained no alkaloid whatever.

The fact that lettuce contains a poisonous alkaloid is not of great importance in connection with its use as a vegetable, since it is only used for this purpose in the early stages of its growth, before the bitter milk has been produced, when the hyoscyamine is only present, if at all, in minute quantities. The amount of mydriatic alkaloid in

the extract prepared from garden lettuce when in flower is not more than 0·02 per cent. Nevertheless, cases have been recorded in which the immoderate consumption of lettuce has led to unpleasant and even fatal results. Lettuce belongs to the natural order *Compositæ*. This is the first occasion on which hyoscyamine has been found in plants not belonging to the natural order *Solanaceæ*. (*By T. S. Dymond, from the Research Laboratory of the Pharmaceutical Society of Great Britain.*)

Tagetes erecta.

The flowers contain a crystallizable substance *quercetagetin*, having the composition $C^{27}H^{22}O^{18}+4H^2O$; it is the yellow colouring matter; its reactions in alcoholic solution are the same as those of quercetin, but it differs from the latter in crystalline form and solubility in alcohol. (*Bull. Soc. Chim.* [27] xxviii., 337.)

Saussurea Lappa.

Schimmel & Co. in their Report (April, 1892) state that Kusht root yields one per cent. of a light yellow essential oil, which possesses a sp. gr. of 0·982, and a rotatory power of + 15° 20′ in a tube of 100 mm. It begins to boil at 275°, and about one-half goes over below 315°; then complete decomposition takes place, producing a very disagreeably-smelling vapour. When treated with soda, a part of the oil combines with it, and can be separated by acids. The root has a violet odour, but it does not seem to yield an odorous oil of that perfume. Messrs. Schimmel state that the odour of the oil resembles at first that of elecampane. After the volatilization of this odour, in about 24 hours, the violet odour develops, but not sufficiently strong to indicate that the oil could be of practical use.

Mr. McDonell, Conservator of Forests in Kashmir, reports that the plant grows as high as 9,000 to 10,000 feet. The dried root sells at Rs. 25 per maund. It is collected by villagers and paid for at Tehsils. The chief purchaser is a Bombay Chinaman.

CAMPANULACEÆ.

Lobeline.

The only active principle of *Lobelia inflata* has recently been investigated by Dr. H. Dresser.

Warm-blooded animals poisoned by means of lobeline succumb to respiratory paralysis, so it is to be included among the respiratory

poisons. In dogs the physiological action of lobeline is first manifested by a paralysis of the voluntary movements and by a concomitant exaggeration of the reflexes. Later these effects are complicated by a paralysis of the motor nerves, analogous to that produced by curare. Through its paralyzing action on the cardiac branch of the pneumogastric, lobeline resembles in its action the nicotine group. In warm-blooded animals the influence of lobeline is found in a great exaltation of the respiratory activity. It produces an acceleration of the respiratory movement, which is more persistent when the pneumogastric nerves are intact than when they have been divided. Further, the amplitude of the respiratory movements is increased, and the power of the respiratory muscles appears to be also augmented. Under the influence of comparatively small doses of lobeline, the inhibitory influence of the pneumogastric on the heart, as well as its action on the bronchial muscles, is suppressed. The respiratory muscles appear to receive especial stimulation from the respiratory centre when the latter is under the influence of lobeline; as a result, the work accomplished by the heart and respiratory muscles is greatly augmented. In comparison with the other agents which stimulate the respiratory functions, lobeline possesses the advantage over hydrocyanic acid in its freedom from depressing action, while it surpasses aspidospermine in energy. It therefore seems evident that the employment of lobeline as an anti-asthmatic is substantiated by experimental facts, though the author has not made any clinical experiments and offers no suggestions as to the proper form of employment of this alkaloid. (*Archiv. für Experimentelle Pathologie und Pharmacologie*, 26 Band, Heft 3 und 4.)

H. Paschkis and A. Smita (*Akademie d. Wissen., Wien*, April 17, 1890, through *Chem. Zeit.*, 1890, 594) use the following method for preparing lobeline: The herb of *Lobelia inflata* is extracted with water, acidified with acetic acid, the extract partly evaporated, made alkaline and extracted with ether. An extract was taken up with water and being acid was made alkaline and shaken with ether. The ether was evaporated and the alkaloid obtained as a thick oil of a yellow colour. For purifying, the alkaloid was dissolved in ether, shaken with water acidulated with hydrochloric acid, then made alkaline and taken up with ether. This was repeated three times, the ethereal solution then dried with potassium hydrate, and the ether distilled in an atmosphere of hydrogen. The free alkaloid

or the sulphate was suspended in 10 per cent. potassium hydrate solution and treated with 4 per cent. potassium permanganate, until the green colour disappeared only slowly. The mixture was then filtered, acidified with sulphuric acid, extracted with ether, this evaporated and residue recrystallized from water. This proved to be benzoic acid. (*Am. Journ. Pharm.*, July, 1890.)

PRIMULACEÆ.

Anagallis arvensis.

A. Schneegas (*Journ. Pharm. von Els. Lothr.*, 1891, 171) has separated from this plant two glucosides identical with those obtained from quillaia and senega. The plant is said to be used in Mexico as a substitute for soapwort.

SAPOTACEÆ.

Indian Gutta-percha.

The natural sources of supply of gutta-percha, and the possibility of their exhaustion, were referred to in the *Kew Reports*, 1876 (p. 23); 1887 (pp. 30, 31); and 1881 (pp. 38-45). A few trees, natives of the Indian peninsula, yield substances more or less similar to gutta-percha. One of these is *Dichopsis elliptica*, Dalz. (=*Bassia elliptica, Isonandra acuminata*).

The following note on this plant appeared in the *Report of the Royal Gardens, Kew*, 1881, p. 44 :—

"This tree appears to be common on the Malabar Coast, the forests of Coorg, the Wynaad, Travancore, &c. It grows to a height of 80 or 90 feet. A substance similar to the gutta-percha of commerce is procured by tapping, but the tree requires an interval of rest of some hours, or even of days, after frequent incision. In five or six hours upwards of 1½ lbs. was collected from four or five incisions. The gum is hard and brittle at the ordinary temperature, but becomes sticky and viscid on the increase of heat. It is not found applicable to all the purposes for which gutta-percha is used, but 20 or 30 per cent. of it may be mixed with gutta-percha without destroying its qualities."

The same tree is referred to in Watt's *Dictionary of the Economic Products of India*, Vol. III., p. 102. In this, an extract taken from Drury's *Useful Plants of India*, suggests that the gum might be usefully utilised as a sub-aqueous cement or glue; or that, on account of its perfume when heated, it might possibly be rendered of some value to the pastille and incense makers. More recently this gum has been analysed by Mr. David Hooper, F.C.S., F.I.C., Quinologist to the Government of Madras, and the results are given in the *Annual Report of the Cinchona Plantations of Madras* for 1891, p. 18:—

"*Indian Gutta-percha.*—An abundance of gutta-percha milk has been yielded during the dry weather in the Wynád by the Panchotee tree (*Dichopsis elliptica*), and some planters have been asking for information on the subject, and inquiring whether it could be made into a commercial article. The milk has been known for some years to afford what was called Indian gutta-percha or Pala-gum, and has been used as an adulterant of Singapore gutta. General Cullen brought it to notice 35 years ago, and Dr. Cleghorn published a memorandum on the subject at the time. It was reported upon by experts in London, who found that it was unfit for water-proofing purposes, as its solution in coal-tar and turpentine dry up to such a brittle consistence that the fabric is useless. It could be used as a birdlime or cement, and keeps well under water as a cable insulator, especially if mixed with some genuine gutta. By boiling the milk of the Panchotee tree, a white mass separates, which can be kneaded by the fingers, but which becomes hard and brittle when cold. The brittle character of this substance, I find, is due to a large proportion of a crystalline substance found also in true gutta, and called crystalban or alban. Crystalban, according to Payen, occurs to the extent of 14 to 19 per cent. in the best kinds of gutta-percha, but I have extracted as much as 69·2 per cent. of crystalban from the dried secretion obtained from Wynád. The presence of a large quantity of crystals in this gum, of course, would interfere with its utility, but crystalban is easily removed by boiling alcohol, and the residue consists of a very good and pure gutta-percha. I cannot see why this process could not be used to purify the Indian gum and so obtain an article similar to the Malayan article."

A note on a gum from a closely allied plant (*Dichopsis obovata*, C. B. Clarke) received at Kew from Burma appeared in the *Kew Bulletin*, 1892, p. 215. (*Kew Bulletin*, Dec. 1892.)

STYRACEÆ.

The Varieties of Benzoin.

The source of the different varieties of gum benzoin known to commerce, and many points regarding the mode of preparation of the drug, are still, to a large extent, matters of conjecture. Some authorities, including Dr. Treub, the well-known director of the Buitenzorg botanical gardens, are of opinion that Penang and Palembang benzoin are yielded by the same tree, and that the difference in the appearance and in the yield of cinnamic acid of the two kinds is caused by differences in their mode of preparation. Mr. Holmes does not agree with this view, but inclines to the belief that the Sumatra and Palembang varieties are both produced by the same tree—styrax benzoin—and that the Penang gum is *sui generis*, probably the produce of the *Styrax subdenticulata*, Miq., which occurs in Western Sumatra. Hanbury offers no definite opinion on the subject, nor does Flückiger, in his last edition, just published, of the *Pharmacognosie*. Contributions to the elucidation of a subject upon which so much divergence of view exists among authorities are always welcome, and they become doubly valuable when they are the result of careful local examination. In London the druggists distinguish four varieties of benzoin, *viz.*—Siam, the costliest variety; Sumatra, which comes next in value; Penang, which is a comparatively recent addition to our Materia Medica, and Palembang, the kind mostly used by benzoic-acid manufacturers. Leaving Siam gum, which is obtained from the mainland of Asia, out of account altogether, it is evident that the nomenclature of the remaining three varieties is not only altogether fanciful, but actually calculated to mislead. In Penang itself no benzoin is produced, and the gum which is imported by way of that great emporium of the trade of the Dutch East Indies is almost entirely, if not wholly, collected in the island of Sumatra. Palembang gum also is the produce of the same island, Palembang being simply the chief settlement of the residency of the same name, in the south-eastern part of the island of Sumatra, where a great part of the benzoin of commerce is brought to market, and whence it is sent on to Singapore or Penang on its way to Europe. Sumatra, though it has been nominally under Dutch rule for over two centuries, still contains some of the least-known spots on earth, and the detailed account of the cultivation and collection of benzoin

in one of the remoter districts of the island, which we owe to Mr. L. M. Vonck, a member of the Dutch-Indian Civil Service, stationed at Sekajôe, in Sumatra, and which is published in the last issue of the Journal of the Netherlands Society for the Advancement of Industry, is, therefore, an acceptable addition to our knowledge of the collection of this important drug and the manner in which it passes into commerce. Mr. Vonck does not refer to the gum, of which he speaks either as Palembang, Penang, or Sumatra benzoin, and it may, therefore, be taken for granted that those classifications are unfamiliar to him. The gum of which he writes, and which appears the only kind brought into commerce from south-eastern Sumatra, is evidently all obtained from one tree, and seems to correspond with the kinds known to our druggists as Penang and Palembang. So far as his evidence goes, therefore, it certainly favours Dr. Treub's opinion that there is no difference between the commercial source of Penang and Palembang benzoin. The benzoin-tree (*Styrax Benzoin*, or, in Malay, pohon Kemenjan, or Menjan) occurs, according to Mr. Vonck, in various portions of the high and low lands of the residency of Palembang. It grows up to an altitude of about 600 feet above sea-level, either in small clusters or sporadically between other trees. Formerly little attention appears to have been paid to benzoin-culture. At any rate, the standard writers on the products of the Dutch Indies only mention benzoin as being collected from wild-growing trees in the virgin forests of the Upper Blitie, on the Lalang and Toengkal rivers, and in the wilds of Batang Lakoh in the country of the Koeboes. But the easy nature of the culture, and the high prices which good benzoin realised in former years (from £6 to £8 10*s*. per picul), acted as strong incentives to the extension of the plantation. There are only a few parts of the residency of Palembang in which the benzoin-tree is either scarce or non-existent. In some other districts the tree is found wild, but its gum is never collected, nor is the tree cultivated systematically. The principal districts in which the benzoin-tree is systematically cultivated in gardens are the divisions of Iliran, Banjoeasin, and Moesi Ilir. In the Koeboe country, already referred to above, in the virgin forests of which the benzoin-tree was formerly of very common occurrence, it has now almost been extirpated. The tree flourishes in various kinds of soil, but experience shows a high, dry sandy soil, free from danger of inundation, to be most fitted for its

propagation. On low-lying, rich, and clayey soil the tree grows up more rapidly, but its gum is then of such a poor quality that the cultivation yields little or no profit. On such a soil there is also danger of floods, which are fatal to the tree. Marshy or stony soil is altogether unsuited to the culture. The tree is propagated from the seed, which is of a reddish colour, almost round in shape, and of the size of a marble. It is enclosed in a green shell. When the would-be planter has gathered a sufficient quantity of the seeds, which are a favourite food of wild beasts of the forest, he plants them out in rows in the paddy-field, just before the paddy crop is put in the ground. Sometimes the young benzoin-shoots which have grown up around the parent stem are dug out and transplanted among the paddy. The object of the plantation on the paddy-field is to secure the necessary shade for the seedlings, which would be easily killed by the fierce sunlight. Two seeds are usually planted in one hole; if both come up, the weaker plant is generally destroyed. If the culture takes place by means of young shoots from the parent tree, these shoots, before planting, are stripped of their leaves, and placed in water in bunches of about twenty-five, being kept afloat between two bamboo sticks. When fresh leaves have grown upon the shoots, they are planted out in an oblique hole, which is left open for a time. The new benzoin-tree grows from the roots of the young shoot, after which the stem of the latter perishes. The natives appear to take no trouble whatever in weeding their benzoin plantations, and many of the plants are therefore suffocated by creepers and weeds. Only after a lapse of seven years the native returns to the spot where he planted his seeds or shoots for the purpose of gathering his first crop of juice. By that time the shoot has grown into a fine tree, branching and bearing leaves at the top only, and from 25 to 40 feet in height. When once the tapping of the tree has commenced, its growth is almost arrested, and the colour of its bark gradually changes from pale grey to brown. If the tree is left to grow wild, its height trebles or quadruples, some of the specimens in the virgin forest being over 250 feet high. The incisions made in the tree are almost triangular in form, and are made at regular intervals and on a systematic and invariable plan. A yellowish juice begins to exude from the incisions a week after they are made, but not until six weeks or two months after its appearance has it hardened sufficiently to admit of being collected. The tree becomes exhausted between its

seventeenth and its nineteenth year, the drying-up process commencing at the lower part. The natives collect three different qualities of gum, classed according to the lightness of their colour and their freedom from bark and other impurities. A full-grown benzoin-tree yields from 1 to 3 catties ($=1\frac{1}{3}$ to 4 lbs.) every season, and its cultivation is a source of considerable affluence to its proprietor. In the Moesi Ilir District several proprietors own from 500 to 7,000 benzoin-trees each. During the recent years of low prices, however, the cultivation has been carried on with great want of care, and in some parts a garden of 2,000 trees now yields hardly as much gum as a garden of 500 trees did when, some years ago, the collection of gum was carefully attended to. Still, the benzoin-producing villages of Sumatra are among the most prosperous in the whole island. If, through carelessness, as sometimes happens, the collection of the gum from some trees is forgotten during the season, the gum, after some months, is found to have exuded in great lumps, which have become quite hard, and are covered with a dirty layer of black. These pieces are cut from the trees with an axe, and roughly rinsed in the nearest creek. Afterwards hot water is poured over this gum, which softens it and renders it fit for packing. Palembang is the trade centre for the district, and the Chinese merchants there are the principal, if not the only, buyers. They systematically adulterate the benzoin by the addition of inferior gum-resins, wood, or earth, and it is said that for many years not a single parcel of pure benzoin has been exported from Palembang. The average benzoin exports from Palembang are about 700 tons per annum. Mr. Vonck mentions that the gum exported from Padang on the west coast of Sumatra is more valuable than that brought into commerce from Palembang. This has sometimes been ascribed to its greater richness in cinnamic acid, but Mr. Vonck believes it to be due rather to the greater care which is bestowed upon its collection. As the Penang and Palembang gums are the least valuable on the London market, and their prices correspond most nearly to the figures given by Mr. Vonck as the local value of the gum, equalling from about 5*s*. to 40*s*. per cwt.; this may be taken as additional evidence in favour of the view that the Palembang and Penang varieties are identical, and that the gum known in London as "Sumatra" is the product of the western districts of Sumatra, and may possibly be obtained from a different tree. (*Chemist and Druggist*, Sept. 26, 1891.)

An interesting paper on the origin of Benzoin by Fritz Ludy appeared in *Archiv de Pharmacie*, 231-43, an abstract of which is contained in the *Pharm. Journ.*, April 29, 1893.

APOCYNACEÆ.

Rauwolfia serpentina, *Benth.*

Note on certain reactions of an alkaloid contained in the roots.

In the *Pharmacogrophia Indica*, Vol. II., p. 416, one of us described the proximate composition of the root of the *Rauwolfia serpentina*, Benth., and noted the presence of one or more alkaloidal principles. This communication deals chiefly with the colour reactions of an alkaloid which we have separated from the roots, and provisionally termed pseudobrucine.

The isolation of the alkaloid in a pure condition was attended with difficulty. In our first experiments, the pounded root was exhausted with boiling 80 per cent. alcohol, and the alcohol free extract treated with cold water acidulated with sulphuric acid, by which a large amount of dark resinous matter was separated. The aqueous acid solution was then precipitated with Mayer's reagent, but the precipitate on decomposition did not yield the alkaloid in a pure condition, owing to a certain amount of resinous matter being precipitated with the alkaloid by the reagent, and which was subsequently dissolved by the amylic alcohol employed to separate the alkaloid after its liberation from the mercury compound. Attempts were made to separate dissolved resinous matter from the aqueous acid solution of the alkaloid by agitation with amylic alcohol, but the sulphate of the alkaloid was freely soluble in this alcohol. In ether the alkaloid was only very slightly soluble. Ultimately, the pounded root was percolated with chloroform, the chloroform evaporated off, and the extract treated with water acidulated with sulphuric acid. The acid aqueous solution of the alkaloid was then agitated with chloroform, which separated some colouring matter and a trace of alkaloid. The chloroform was then separated and the acid solution made alkaline with sodic carbonate and reagitated with chloroform; this series of operations being repeated several times. The final chloroform extract was dried and agitated with ether, which removed traces of colouring matter. The extract now formed a cinnamon-coloured powder, extremely bitter, soluble in dilute acids, and dissolving

in amylic alcohol or chloroform with a very marked greenish fluorescence. An alcoholic solution of the alkaloid did not crystallize, and we failed in obtaining distinctly crystalline salts. A solution of the alkaloid in dilute sulphuric acid afforded with alkaline carbonates and hydrates a bulky white precipitate; but even after repeated precipitation and re-solution, the physical characters of the alkaloid were not materially altered, and its solution in amylic alcohol or chloroform still showed a marked fluorescence. A solution of the alkaloid in dilute sulphuric acid, when agitated with animal charcoal, completely lost its bitterness, the solution being at the same time completely decolourized. The alkaloid could be again separated from the charcoal by treatment with warm alcohol, the physical characters being unaltered.

The following colour reactions were noted, pure brucine being tested at the same time as a control:—

Reagent.	Brucine.	Alkaloid suspected to be Brucine.
Conc. sulph. acid containing a trace of nitric acid.	Pink	Yellow.
Conc. hydroc. acid ...	Colourless	Yellow.
Acetic acid	Colourless	Yellow.
Conc. nitric acid ...	Scarlet, soon passing into yellow.	Scarlet, does not become yellow so soon as the brucine, but only after standing for some time.
Sulph. acid and bichromate of potash.	Yellow, with tinge of red ...	Slight purple, not unlike the strychnia reaction, but not so marked.
Sulph. acid and MnO^2.	Orange	Violet, changing to dark brown.
Chlorine	Red: colour soon discharged, decolourized by ammonia.	Red: colour not so soon discharged, decolourized by ammonia.
Mercurous nitrate, with slight excess of HNO^3.	Pink on warming, colour deepens on standing.	Yellow on warming, but no pink colour.
Mayer's reagent ...	Pale yellowish ppt., flocculent.	Pale yellowish ppt., flocculent.
Nitric acid and $SnCl^2$.	Purple, discharged by excess of both reagents.	No purple colour.
Sulphuric acid and potassium nitrate.	Red, changes soon into yellow.	Red, with greenish-purple tint at the edges; red colour deepens on standing.
Sulphocyanide of potassium.	White ppt., sol. in excess of acetic acid, repptd. by NaHO.	White ppt., sol. in excess of acetic acid, repptd. by NaHO.

Reagent.	Brucine.	Alkaloid suspected to be Brucine.
Bichromate of potassium in acetic acid solution.	Copious yellow ppt., with difficulty soluble in large excess of acetic acid.	Copious yellow ppt., with difficulty soluble in large excess of acetic acid.
Platinic chloride ...	Thick yellowish floc. ppt., with difficulty soluble in acetic acid, but with exception of a few flocks completely soluble in NaHO.	Thick yellowish floc. ppt., readily soluble in acetic acid, but almost insoluble in NaHO.
Auric chloride ...	Dirty white floc. ppt., soon changing to flesh colour, soluble in excess of acetic acid, but insol. in NaHO.	Beautiful purplish-red ppt., soon changing to dirty brown, with a green tinge, sol. in excess of acetic acid, but insol. in NaHO.
Potassium ferrocyanide.	Light yellow ppt., soluble in dilute H^2SO^4. The presence of acetic acid in slight excess prevents precipitation.	Light yellow ppt., sol. in dil. H^2SO^4. The presence of acetic acid in slight excess does not prevent precipitation.
Alcoholic solution of iodine.	Alcoholic solution of alkaloid, rosette crystals.	Alcoholic solution of alkaloid, no crystalline forms on microscopic examination.

Two experiments were made to determine whether the alkaloid possessed any physiological properties similar to brucine. In the first experiment ·15 gramme was dissolved in three drops of acetic acid diluted with about two drachms of water, and injected into a cat's stomach at 11-21 A.M.

11-37 A.M.—A quantity of half-digested food was vomited; there was a good deal of frothy mucus and constantly dribbling saliva, movement of the jaws, and application of the paws to the mouth as if to remove some irritant matter; the animal restless and much distressed.

12-30 P.M.—Frothy mucus and saliva still flowed from the mouth, but in smaller amount; vomiting ceased, but now and then retches; animal not so restless.

1 P.M.—Discharge of saliva ceased; animal quiet, no further symptoms developed.

In the next experiment ·022 gramme of the alkaloid was dissolved in acetic acid, the solution evaporated to dryness, the residue dissolved in a few drops of distilled water, and the solution hypodermically injected into the left hind leg of a small frog at 11-40 A.M.

The frog was placed under a large glass funnel and jumped about, a tap on the glass being sufficient to make it change its place.

11-44 A.M.—Frog showed no inclination to move; when its back was touched with a glass rod it made feeble attempts to move its limbs; some loss of power was evident, but there were no twitchings of the limbs or convulsive movements.

11-46 A.M.—The frog did not move its limbs even when tapped on the back; the left leg appeared quite paralysed.

11-50 A.M.—The limbs were quite lax, and might be placed in any position without the animal making any effort to move them. When placed on its back, it now and then made feeble attempts to move the right leg; then the movements stimulated slight twitchings. After this, and until its death at 12 noon, it lay motionless, the only sign of vitality being an occasional gasp; limbs flaccid, no convulsions. As a control experiment, another frog, a little larger, was injected with the same amount of brucine. Two minutes after the injection it was perfectly motionless; there was evidently loss of voluntary power over the limbs. When placed on its back and touched, it made no effort to move, but slight twitchings of the limbs were noticed, which became more marked in about a couple of minutes. Touching the back, pinching the limbs, or even gentle tapping on the table, was now sufficient to produce rather feeble convulsive movements, but there was no spasm, except when thus regularly induced. The frog died about ten minutes after the injection. After death the limbs were not stiff but rather flaccid.

Many of the reactions we have described as being afforded by the alkaloid we have provisionally termed pseudobrucine were identical with those yielded by brucine; while, on the other hand, certain reactions were quite different. The history of the drug shows that it is employed as a domestic remedy in the treatment of a large number of affections, but there is no evidence to indicate that it is supposed to possess any toxic properties. When we are satisfied that we have obtained the alkaloid in a pure state, its ultimate composition, &c., will be determined. (*C. J. H. Warden and Assistant Surgeon Chuni Lal Bose, Pharm. Journ.*, Aug., 1892.)

Oleander as a diuretic and heart-tonic.

F. v. Oefele (*Pharm. Pr.*, Oct. 24, 1891, pp. 2-5) draws attention to the action of this plant as a diuretic and heart-tonic in place of

digitalis. He considers an infusion of the fruit to be preferable to all other preparations: the infusion may be preserved from deterioration by the addition of a little glycerine or spirit. Dr. von Oefele considers that a maximum dose of ¾ of a gram of the raw drug or its equivalent in solution should not be exceeded in the 24 hours. (*Nouveaux Remèdes*, Jan. 24, 1892.)

Hunteria corymbosa, *Roxb., Wight Ic., tt.* 428, 1294; *Bedd. For. Fl. ii., t.* 265.

The bark of this tree, a native of the Deccan Peninsula, Coromandel Coast, Tavoy, Penang, and Ceylon, has been shown by Greshoff (*Meded. uit S'lands Plant.*, vii., p. 55) to contain 0·3 per cent. of a crystalline alkaloid, which also forms crystalline salts, and gives a beautiful violet coloration with Erdmann's and Fröhde's reagents. It is a strong poison, and has a sharp, burning taste, even when diluted to 1: 10,000.

Vinca pusilla.

This plant is called Mulakapundu in Tamil, and the ryots of South Arcot say that if cattle graze upon it they become giddy and die. We have chemically examined this plant, and find that the poisonous property is due to an alkaloid named *Vincine*, which is distinguished by giving a carmine-red colour with pure nitric acid.

ASCLEPIADEÆ.

Gymnema sylvestre.

In doses of 0·3 to 0·4 gram, gymnemic acid acts as an emetic. In much smaller doses it is stated to be very effective for distinguishing the taste of bitter drugs. For this purpose a ½ per cent. aqueous solution containing a small addition of alcohol is used for rinsing the mouth immediately before taking the medicine.

The acid is obtained by moistening the powdered plant with a solution of caustic soda, allowing the moist mass to stand in a percolator for two days, and then extracting with benzin. After removing the benzin from the percolate by distillation, the residue thus left is repeatedly washed with ether and dried. The product forms a brownish crystalline powder, which is soluble in 100 parts of water, freely soluble in alcohol and insoluble in ether and chloroform. It is decomposed by acids. (*A. Quirini, Pharm. Zeitung*, 1891, 401.)

LOGANIACEÆ.

Strychnine in snake-bite.

An interesting illustration of the antagonistic action of poisons is given in a letter we have received from Mr. W. Rushton, addressed to his brother in Tasmania by Dr. Mueller, of Yackandandah, Victoria, in which he states that in cases of snake-bite he is using a solution of nitrate of strychnine in 240 parts of water mixed with a little glycerine. Twenty minims of this solution are injected in the usual manner of a hypodermic injection, and the frequency of repetition depends upon the symptoms being more or less threatening, say from 10 to 20 minutes. When all symptoms have disappeared, the first independent action of the strychnine is shown by slight muscular spasms, and then the injections must be discontinued unless after a time the snake-poison again reasserts itself. The quantity of strychnine required in some cases has amounted to a grain or more within a few hours. Both poisons are thoroughly antagonistic, and no hesitation need be felt in pushing the use of the drug to quantities that would be fatal in the absence of snake-poison. Out of about one hundred cases treated by this method, some of them at the point of death, there has been but one failure, and that arose from the injections being discontinued after one and a quarter grain of strychnine had been injected. Any part of the body will do for the injections, but Dr. Mueller is in the habit of making them in the neighbourhood of the bitten part or directly upon it. (*Pharm. Journ*, June 13, 1891.) These results are opposed to the experiments instituted by the Commission appointed in India to investigate the influence of artificial respiration, intravenous injection of ammonia, &c., in Indian and Australian snake-poisoning (1874). More recently, A. A. Kanthack (*Jr. Physiology*, Vol. XIII., Nos. 3 and 4, 1892) has shown that strychnine is neither a chemical nor physiological antidote of cobra-albumose; and he is of opinion that "no false hopes should be raised or fostered as to a cure by strychnia."

BORAGINEÆ.

The active principle of the Borragineæ.

Schlagdenhauffen and Reeb have examined the roots, stalks, leaves, and seeds of *Cynoglossum officinale* and *Heliotropium europæum*. Petroleum ether extracted from the roots a coloured substance

analogous to alkanet red. By subsequent treatment with alcohol an alkaloid was obtained which the authors term *cynoglossine*. It is hygroscopic, combines with acids, forming uncrystallizable salts which are decomposed at 100° C. The base was also found in the seeds, but not in the leaves or stalks. Cynoglossine has a toxic action; injected hypodermically 0·001 to 0·002 gram caused violent convulsive movements in a frog, followed by death after several hours. 0·050 gram repeated several times caused nausea and vomiting in a pigeon and death without convulsions. In a rabbit weighing 3·500 kgs. a dose of about one gram produced narcotism and convulsive movements. (*Pharm. Post*, xxv., 1.)

We have received from Afghanistan, under the names of *Gaozaban* and *Gul-i-gaozaban*, the leaves and flowers of *Trichodesma molle*, DC.; and Aitchison (*Notes on Prod. of W. Afghanistan and N.-E Persia*, p. 12) records the collection of the corollas of *Anchusa italica*, Retz., to be employed as *Gul-i-gaozaban*.

SOLANACEÆ.

Lycopersicum esculentum, *Miller*.

The tomato fruit has been chemically examined by G. Briosi and T. Gigli. On an average the fresh fruit contains: Seeds 10·9 per cent., pulp 85·4 per cent., and skin 3·7 per cent. The pulp can be separated into a yellow juice and a red residue, which is tasteless after washing; the juice on an average has the specific gravity 1·0217, and contains levulose, citric acid (0·4 to 0·65 per cent. of the juice), albuminoids, and ash which is composed of 60 per cent. potassium salts. Minute traces of alkaloid are indicated; tartaric acid could not be detected. The red residue will impart its colouring matter to ether, alcohol, chloroform, and aqueous alkalies. The alcoholic solution is not changed by ferric chloride, dilute acids or lkalies; on addition of strong nitric acid a transient blue colour is produced; the residue on evaporating the alcoholic solution becomes blue by adding sulphuric acid; the colouring matter resembles that of saffron. (*Chemiker Ztg.*, 1891, 205.)

Mr. Frederick Davis has found that English-grown tomatoes subjected to distillation with water afford a volatile substance analogous to oil of onions or garlic. The crude oil obtained by distilling twenty-eight pounds consisted of oxide and sulphide of allyl. The

crude oil was acted upon by metallic potassium to separate the oxygenated product, and the pure oil removed; this upon analysis proved to be represented by the formula $(C^3H^5)^2S$. (*Year-book of Pharmacy*, 1892, p. 515.)

Solanaceous Alkaloids.

The surprising statement made rather more than three years since, by Messrs. Schering, that belladonna roots contain practically only hyoscyamine, and that atropine obtained from them is probably a product of change occurring during the manufacture, suggested to Dr. Schütte to undertake a thorough investigation of the subject, and he has just published his results in a long and interesting paper (*Archiv*, Oct. 30, p. 492). In the first place the influence of methods of preparation upon the conversion of hyoscyamine into atropine was tested. Dr. Will had already stated that contact with an alkali is sufficient to effect this change, and Dr. Schütte found that the same result is produced by repeated recrystallizations from acidulated water, as well as by long keeping of hyoscyamine in solution or in the form of a gold salt. It was further ascertained that in fractional precipitation the gold salt of atropine, if any should be present, is thrown down before that of hyoscyamine, and the inference has been drawn that if any atropine gold salt be thrown down at the commencement of the precipitation in a properly-conducted experiment, it represents atropine existing as such in the plant-part, and that any obtained from a mother-liquor after the removal of the hyoscyamine represents a product of alteration. The influence of age and period of vegetation upon the alkaloids in the roots was next investigated. It was found that young fresh roots (1 to 2 years), collected from a basaltic district, whether gathered in the spring, summer or autumn, contained only hyoscyamine, but that older roots (8 years and upwards) always contained, besides much hyoscyamine, a little already-formed atropine. Similar results were obtained with roots from old cultivated plants and roots that had been kept several years. The amount of alkaloid was considerably greater in the roots collected in summer than in the spring roots, and fell off again in the autumn, but more rapidly in the old than in the young roots. The averages obtained at the three periods were for young roots 0·127, 0·452, and 0·458 per cent., and for old roots 0·174, 0·358, and 0·280 per cent. Spring and autumn

leaves of the belladonna plant both contained principally hyoscyamine, with small quantities of ready-formed atropine. As to the fruit, the unripe berries of the wild plant contained chiefly hyoscyamine and a little atropine, but the ripe fruit contained only atropine. The ripe berries of cultivated plants, however, yielded both hyoscyamine and atropine, while the ripe berries from var. *lutea* gave atropine and a small quantity of a base probably identical with Hesse's atropamine. Turning to other Solanaceous plants, fresh and old stramonium seeds yielded chiefly hyoscyamine, together with small quantities of already-formed atropine, and scopolamine. The leaves of the potato plant (*Solanum tuberosum*), besides yielding betaine, gave indications of the presence of an alkaloid having a mydriatic action, which seemed also to resemble a mydriatic base present in *Solanum nigrum* and *Lycium barbarum*. The leaves of *Nicotiana tabacum* also yielded traces of a mydriatic alkaloid, and lastly the seed, herb, and root of *Anisodus luridus* all contained hyoscyamine only. (*Pharm. Journ.*, Nov. 28, 1891.)

Tobacco Smoke.

Tobacco-smoke varies in character according to the proportion of air admitted during combustion, oxidation being necessarily more perfect in the case of a cigar than when the tobacco is smoked in a pipe. In the latter case, a portion of the condensible products is deposited in the liquid state. Tobacco-smoke consists in part of permanent gases, the proportions of carbon dioxide and carbon monoxide in which have been determined by G. Krause. Vohl found sulphuretted hydrogen and hydrocyanic acid, and from 0·7 to 2·8 grammes of ammonia for 100 of tobacco smoked. Vohl and Eulenberg (*Arch. Pharm.*, [2], cxlvi., 130) experimented on the smoke of strong tobacco, burnt both in pipes and in the form of cigars. The smoke was first aspirated through a solution of caustic potash, and then through dilute sulphuric acid. The alkali absorbed carbon dioxide, sulphuretted hydrogen, hydrocyanic, formic, acetic, proponic, butyric and valeric acids, phenol and creosote; the presence of caproic, caprilic and succinic acids could not be ascertained conclusively. The acid absorbed ammonia, pyridine, C^5H^5N, and all the homologues of the series to viridine, $C^{12}H^{19}N$, inclusive. In addition to the above, carbon monoxide, methane, and several hydrocarbons of the acetylene series were detected. Pyridine was the chief base in the smoke

from pipes, while collidine was the prominent base in cigar-smoke. Vohl and Eulenberg conclude that the nicotine of tobacco is completely decomposed during the process of smoking, and that the intense action of tobacco-smoke on the nervous system is due to the presence of bases of the pyridine series. There is no doubt that some observers have mistaken these bases for nicotine; but Melsen's experiments (*Dingl. Polyt. Jour.*, xlvii., 212) appear to be conclusive as to the presence of nicotine, which that chemist isolated in a condition fit for analysis, and to the amount of about 33 grammes for 4½ kilogrammes of tobacco smoked, or about one-seventh of the quantity originally present. (*Allen's Com. Organ. Anal.*, iii., pt. 2.) A. Gautier has since observed that the volatile liquid products formed when tobacco is smoked in a pipe consist chiefly of basic compounds. They contain a large proportion of nicotine, a higher homologue of nicotine $C^{11}H^{16}N^{2}$, which pre-exists in tobacco leaves, and a base $C^{6}H^{9}NO$, which seems to be a hydrate of picoline. Other less volatile bases, including hydropyridines, are also formed. These alkaloids result from the decomposition, at a comparatively low temperature, of the carbopyridic and carbohydropyridic or analogous acids present in tobacco. (*J. Chem. Soc.*, April, 1893.)

The alkaloidal contents of the Seeds and Tincture of Datura Stramonium.

The principal constituents of stramonium seeds, according to Flückiger and Hanbury's *Pharmacographia* (p. 461), are an alkaloid, existing in combination with malic acid, and a fixed oil, of which the seeds are said to contain 25 per cent. The alkaloidal constituent was first isolated by Geiger and Hesse in 1833, and in 1850 was submitted to examination by Von Planta, who came to the conclusion that it was identical with atropine. This statement was subsequently confirmed by E. Schmidt (*Ber. der Deutsch. Chem. Ges.*, xiii., 370), who, however, afterwards modified his views, and concluded that daturine was really a mixture, in varying proportions, of atropine and hyoscyamine (*Archiv. der Pharmacie*, xxii., 329).

Ladenburg also showed (*Berichte Chem. Ges.*, xiii., 909) that stramonium contains two alkaloids, which he designated heavy and light daturine, the former consisting of atropine and hyoscyamine, and the latter of hyoscyamine only.

As to the distribution of the alkaloid in the plant, and the comparative strength of the seeds and the leaves, very little reliable information is obtainable.

Hurtz and Hopp (*Annal der Therap.*, 1862, p. 22) inferred, from experiments made by them, that an extract from the seeds possessed five times the physiological activity of an extract from the leaves. Evidence of this kind is, however, of very little value unless the proportionate amount of extract obtained from the seeds and the leaves is stated, as the yield varies within wide limits. The alkaloidal content of the seeds is given in *Pharmacographia* as ·1 per cent. and that of the leaves as ·02 to ·03 per cent.

Hurtz (*Druggists' Circular*, Aug., 1884) reports having obtained a yield of daturine from the seeds of ·167 per cent.

E. Schmidt (*Year-book of Pharmacy*, 1885, p. 242) obtained from 5 kilos of each of four specimens of seeds, 12·5, 18·4, 2·6, and 10·2 grams alkaloid, equivalent to a percentage yield of ·25, ·37 ·05, and ·20 respectively.

A. B. Lyons (*Manual of Practical Assaying*), estimating the alkaloid by titration with Mayer's solution, found the average yield of alkaloid by five specimens of the seeds to be from ·45 to ·55 per cent., and that from eight specimens of the leaves to be ·40 to 25 per cent.

If these results could be trusted, they would appear to indicate that the percentage of alkaloid in the seeds and leaves is practically the same, but the process of estimation by titration with Mayer's solution almost invariably gives results which are too high, and a systematic examination of a number of samples of the seeds and leaves, with a view of ascertaining their relative alkaloidal strength, is still needed.

For the purpose of our experiments, eleven specimens of stramonium seeds were obtained, and a series of tinctures made from each, by the B. P. process, with menstrua of 80, 70, 60, 50, and 40 per cent. strength (by volume). It was remarked that all the tinctures became opalescent when kept, and all threw down a more or less abundant deposit. The latter varied greatly in appearance, that from the 80 and 70 per cent. tinctures apparently consisting of fatty matter in a semi-transparent crystalline condition, while the deposit from the tinctures of lower alcoholic strength was darker in colour and appeared to partake more of a resinous character.

In addition to the seed tinctures, we also prepared, for the purpose of comparison, three series of tinctures from the leaves, menstrua of the same alcoholic strength, and the same proportion of drug to menstruum being used, as in the case of the seed tinctures.

Before proceeding to the quantitative estimation of the alkaloid, a few preliminary experiments were tried, in order to ascertain whether the process employed for the estimation of the alkaloid in tinctures of henbane and belladonna was equally well adapted for the estimation of the stramonium tinctures.

For this purpose 300 c.c. of a standard tincture was prepared with a 60 per cent. menstruum, and the alkaloid estimated by the following processes, the usual precautions being taken to prevent loss of alkaloid in washing with chloroform, &c.:—

Experiment I.—Fifty c.c. of the tincture was evaporated to low bulk with addition of water, until all spirit had been removed. The residual liquor was allowed to cool and was then acidified with dilute sulphuric acid, and freed from fat and colouring matter by means of chloroform. It was then made alkaline, and the alkaloids removed by shaking with three successive portions of chloroform. From the mixed chloroformic solutions the alkaloids were extracted by three agitations with acidulated water, and were afterwards regenerated from the mixed acid solutions, after addition of excess of ammonia, by shaking out with chloroform. The latter solution was then shaken with ammoniated water, and after separation was drawn off and evaporated, and the residue dried at 100° and weighed.

Experiment II.—The tincture was evaporated to low bulk, the residual liquor allowed to cool, and an excess of dilute sulphuric acid added. It was then freed from fat and colouring matter by means of chloroform, a slight excess of ammonia added, the alkaloids shaken out with three doses of chloroform, the latter solutions mixed, and after treatment with ammoniated water evaporated, and the residue dried and weighed.

Experiment III.—The tincture was evaporated till all spirit was removed, and the residual liquor acidified with dilute sulphuric acid and shaken with chloroform and ether in turn, till the latter came away colourless. The alkaloidal solution was then made alkaline with ammonia, the alkaloids shaken out with three successive 15 c.c.

ether (sp. gr. ·717), the mixed ethereal solutions evaporated, and the residue dried and weighed.

Experiment IV.—The tincture was evaporated to remove the spirit, the residual liquor acidified, and colouring matter removed by means of chloroform. It was then made alkaline and the alkaloids extracted with chloroform. From the chloroformic solution the alkaloids were removed by agitation with acidulated water, the latter solution treated with a slight excess of ammonia; the alkaline liquid shaken with three successive portions of ether (sp. gr. ·717), and the mixed ethereal solutions evaporated, and the residue dried at 100°, and weighed.

Experiment V.—This was conducted exactly as No. II., the oil being removed by means of petroleum ether before the preliminary treatment with chloroform.

The results were as follows:—

Experiment	I. 50 c.c.	tincture	=	·014 gram	alkaloids.
Experiment	II. 50 c.c.	„	=	·015	„
Experiment	III. 50 c.c.	„	=	·012	„
Experiment	IV. 50 c.c.	„	=	·010	„
Experiment	V. 50 c.c.	„	=	·014	„

These results indicated that the method of extraction by means of chloroform was thoroughly reliable, notwithstanding the presence of fixed oil in the tincture, and also showed that the preliminary treatment with petroleum ether, in order to remove the oily matter, was unnecessary. Confirmatory experiments with a 70 per cent. tincture, by processes II. and V., gave the following results:—

No. II.	50 c.c.	tincture	=	·015 gram	alkaloids.
No. V.	50 c.c.	„	=	·014	„

The exact details of the process adopted are as follows:—

Fifty c.c. of the tincture to be estimated is introduced into a porcelain dish, and evaporated over a water-bath to low bulk; water being added, if necessary, until all the spirit is removed. The residual liquor is allowed to cool, and is then acidified by the addition of 1 c.c. semi-normal sulphuric acid, and the liquid filtered through cotton wool into a separating funnel. The dish and filter are rinsed first with a little acidulated water and then with 15 c.c. chloroform, the rinsings added to the contents of the funnel and the whole

well shaken. After separation the chloroform is drawn off, and the process repeated with 10 c.c. chloroform. The washings are mixed and freed from traces of alkaloid by shaking with three successive small portions of acidulated water, and these are separated and added to the original solution. The latter is then made alkaline with ammonia, and the alkaloids extracted with three successive 15 c.c. chloroform. To obtain the alkaloids in a pure condition, they are withdrawn from solution in chloroform by agitation with three successive small portions of acidulated water, the mixed acid solutions made alkaline with ammonia, and the alkaloids taken out by agitation first with 10 c.c. and then with two successive 5 c.c. chloroform. In cases where the final acidified aqueous solution was not colourless, the process of shaking out was repeated. The mixed chloroformic alkaloidal solutions were afterwards shaken with ammoniated water, and after separation were drawn off and evaporated over a water-bath, and the alkaloidal residue heated at 100° until the weight was constant.

The above process was found to be applicable to the majority of the tinctures without any modification; but with others greater difficulty was experienced than had been the case in any of the estimations previously made.

This arises from the fact that in many specimens of stramonium seeds there seems to exist some substance soluble both in alcohol and water, and not removable by chloroform either from an acid or alkaline liquor, and which possesses the property of emulsifying chloroform when that liquid is shaken up with a solution containing it.

No difficulty was experienced in removing the oil and colouring matter, but when the extract was made alkaline and shaken with chloroform, emulsification took place, and the chloroform refused to separate out clear, even after standing for some hours. Separation into two layers did, however, take place, the upper layer consisting of a brown alkaline mother-liquor, and the lower layer of emulsified chloroform containing the alkaloid in solution, and holding in suspension some of the mother-liquor. It was ascertained that all the alkaloid was taken out by the chloroform, and two processes were devised, whereby it could be extracted from the chloroform emulsion and obtained in a pure condition. By the plan first adopted, the original alkaline liquor was shaken with three

successive 15 c.c. chloroform, and after separation these were drawn off in turn and mixed. The mixed chloroformic solutions were then shaken up with four successive small portions of acidulated water, by which means all the alkaloid was taken out, together with the mother-liquor included in the chloroform magma, and the latter separated out clear. The acid solutions were mixed and made alkaline, and the alkaloids again shaken out with three successive portions of chloroform. The latter were drawn off and mixed and the process repeated (usually five or six times) until a point was reached where the alkaloidal solution became almost colourless, and a perfectly clear chloroformic solution was obtained. When this point had been attained, the alkaloids were once more extracted with acidulated water, the latter solution made alkaline, the alkaloids again taken out with chloroform, the chloroformic solution shaken with ammoniated water, and after separation drawn off and evaporated and the residue dried at 100° and weighed. The loss of alkaloid by this process is very slight, and there is no waste of chloroform, the same portion being employed all the way through for shaking out the alkaloids, a fresh quantity being used only for the final extraction of the pure alkaloid. The process, however, was a very long and tedious one, each estimation occupying four or five hours.

The following modification was found to give reliable results, and to shorten materially the time occupied by each estimation:—

The chloroform magma is introduced into a separating funnel and shaken vigorously, when, as a rule, about half the chloroform separates out and can be run off. To the remaining emulsion 5 c.c. of 90 per cent. alcohol is added and the whole well shaken and then allowed to stand, when a perfect separation into two layers takes place, the lower layer consisting of chloroform and alcohol, and the upper layer of a brown alkaline aqueous liquid. The whole of the alkaloid is taken out by the chloroform. The latter is drawn off and added to the portion previously separated and the alkaloid extracted by shaking with three portions of acidulated water. The acid solutions are mixed and made alkaline and the alkaloids recovered by means of chloroform. This process is once repeated, and the final chloroformic solution, after shaking with ammoniated water, is drawn off and evaporated, and the residue dried at 100° and weighed. These two modifications of the process of estimation were tried side

by side on four of the most troublesome samples of tincture, and the results in each case were exactly concordant.

The alkaloid as obtained by either of these processes is in the form of a perfectly colourless, transparent fused mass. It is soluble in water and dilute acids, and the reactions generally correspond with those of the alkaloidal residue obtained from the belladonna tinctures.

A glance at the table will show that the most perfect exhaustion of stramonium seeds is effected by the use of a 60 or 70 per cent. menstruum, the average yield of alkaloid by the tinctures prepared with menstrua of these strengths being equal. It is open to question, however, whether a better preparation could not be obtained from the leaves. The chief objections to the tincture prepared from the seeds are that it almost invariably becomes turbid and deposits when kept, and also becomes opaque on dilution, which objections do not apply to a 50 per cent. tincture of the leaves.

The results of the examination of the leaf-tinctures are appended to the table. The leaves from which No. 1 series was prepared were gathered from plants grown by one of us (Farr), and the deficiency of alkaloid is doubtless accounted for by the persistent rain and lack of sunshine which characterized the past season. The tinctures made from the other two specimens, however, gave the same average of alkaloid as the seed-tinctures. Lyons' results, referred to above, go to show that the alkaloidal strength of the seeds and leaves is the same, and should this fact be established as the result of further work upon the subject, we should recommend that this tincture, like those of henbane and belladonna, be prepared from the leaves, on the ground that a 50 per cent. tincture of the leaves is a more elegant pharmaceutical product than a 60 per cent. tincture of the seeds.

The results tabulated go to prove that the alkaloidal content of stramonium seeds does not vary to anything like the same extent as does that of most other drugs, the yield of the tinctures varying between the limits of ·020 and ·034, with an average of ·026 per cent.

This tincture, like those of henbane and belladonna, readily admits of standardization, and the standard should be fixed not lower than ·025 per cent.

The average amount of alkaloid contained in the seeds, calculated upon the basis of our results, is about ·2 per cent.

The percentage amount of the extractive in tinctures was ascertained by evaporating 10 c.c. of the sample over a water-bath, heating the residue at 100° till the weight was constant, and multiplying the result by ten.

It will be remarked that the last five series of tinctures show a much higher yield of extract than the first six, and it will also be noticed that the difference is more marked in the case of the tinctures prepared with the stronger menstrua. This discrepancy is accounted for by the fact that series 1—6 were made, as the Pharmacopœia directs, from the bruised seeds, while the drugs employed in the preparation of series 7—11 were reduced to somewhat fine powder before being converted into tincture. We have previously pointed out, in connection with the tinctures of conium and colchicum, that it is not advisable to reduce the drug to a fine state of disintegration. The sole result, in the case of stramonium seeds, is to expose the oily albumen to the free action of the menstruum, and as a consequence to load the tinctures prepared with the stronger menstrua with a quantity of oily and in all probability inert matter. This is proved (as was the case with tincture of colchicum) by the remarkable variation in the yield of extractive, by the tinctures of higher and those of lower alcoholic strength. As a general rule, the weaker the menstruum, the greater the percentage of extractive in the resulting tincture, but in the case of seed-tinctures this rule is reversed.

Table showing Quantitative Results of Estimation of Samples of Tincture of Stramonium Seeds.

No. of Sample.	Amount of alkaloid in grams from 100 c.c. tincture.					Amount of extractive in grams from 100 c.c. tincture.				
	80 p. c. tincture.	70 p. c. tincture.	60 p. c. tincture.	50 p. c. tincture.	40 p. c. tincture.	80 p. c. tincture.	70 p. c. tincture.	60 p. c. tincture.	50 p. c. tincture.	40 p. c tincture.
1	·030	·034	·032	·030	·030	·52	·54	·54	·60	·61
2	·024	·026	·026	·024	·022	·52	·50	·56	·56	·55
*3	·021	·024	·023	·024	·017	·46	·51	·52	·52	·60
4	·030	·028	·027	·030	·029	·48	·58	·54	·52	·50
5	·028	·029	·028	·028	·026	·59	·61	·64	·78	·70
6	·020	·024	·025	·024	·018	·72	·74	·74	·78	·80
7	·026	·027	·0295	·023	·021	2·50	1·02	1·18	·74	·74
8	·021	·025	·0245	·019	·0205	1·76	1·16	1·24	·90	·70
9	·018	·019	·020	·015	·014	1·44	1·26	·92	·62	·52
10	·020	·023	·024	·021	·015	1·00	·96	·78	·68	·60
11	·021	·025	·023	·020	·018	1·34	1·14	·88	·74	·58
Average	·0235	·0258	·0256	·0234	·0209	1·02	·90	·77	·67	·64

Results of Estimation of Leaf-tinctures.

1	·012	·015	·014	·014	·013	1·60	2·08	2·20	2·46	2·34
2	·024	·028	·028	·028	·028	2·04	2·48	2·68	2·80	2·82
3	·022	·022	·023	·022	·022	1·90	2·04	2·08	2·94	3·08

* Series No. 3 was made from seeds gathered in 1889.

(*By E. H. Farr and R. Wright, "Pharm. Journ.," Jan. 16th*, 1892.)

ACANTHACEÆ.

Note on the presence of a Cholesterol in the roots of Hygrophila spinosa.

In the *Pharmacographia Indica*, one of us described the physical properties of a principle isolated from the roots of the *Hygrophila spinosa*, which was not unlike a cholesterol. Subsequently, through the kindness of Dr. Dymock, we obtained a large supply of the roots, and were able to separate a sufficient amount of the material to admit of its thorough purification and ultimate composition being determined.

For ultimate analysis the principle was crystallized from light petroleum ether, and the combustion made in an open tube in a current of oxygen. The tube had been in use some time and was in very good working order. The results obtained led to the following formula:—

			Calculated for $C^{26}H^{44}O$.	Found.
C^{26}	... ...	312	83·86	83·80
H^{44}	... ...	44	11·82	12·02
O	... ...	16	4·32	4·18
		372	100·00	100·00

At 175° C. (uncor.) the cholesterol commenced to soften, and melted at 184° (uncor.). The fusing point would appear to be higher than that of any cholesterol hitherto isolated. We were unfortunately unable to determine the specific rotatory power.

In purifying the cholesterol an alcoholic extract of the root was dried and exhausted with ether. The dry ether extract was treated with dilute sulphuric acid, and the insoluble residue taken up by ether. The ether extract was next boiled with aqueous caustic potash, the solution evaporated to dryness, and extracted with petroleum ether. The petroleum ether extract was boiled for some hours with alcoholic potash, the solution evaporated to dryness, and extracted with petroleum ether. The petroleum extract was of a yellow colour, and in order to decolourize it, it was dissolved in absolute alcohol, and the solution agitated with purified animal charcoal; this, however, failed to remove the whole of the colour, and the following experiment was adopted. The alcohol was evaporated off,

the residue dissolved in petroleum ether, and the solution agitated with proof spirit; by this means most of the colouring matter was removed. The cholesterol was finally several times crystallized from petroleum ether, and was obtained perfectly white. A benzoyl derivative was also prepared. Evaporated with a drop of nitric acid and the dry residue moistened with ammonia, an orange colour developed, but no change was induced by the addition of caustic potash. The violet reaction with ferric chloride and HCl applied as described by Forti was very marked. The sulphuric acid and chloroform reaction was conducted in a stoppered bottle; the chloroform layer at first became yellowish-brown, then blood-red, finally darkening to reddish-purple; the sulphuric acid and stratum was of a pink colour, and in some experiments fluoresced. (*By C. J. H. Warden, and Assistant Surgeon C. L. Bose, Assistant Chemical Examiner to Government of Bengal.*)

LABIATÆ.

Salvia macrosiphon, *Boiss.*

The Kanocha seeds referred by us (Vol. III., p. 265) to *Phyllanthus madraspatensis* have been shown by Dr. O. Stapt to belong to a species of Salvia. Dr. Stapt bought the drug in the bazaars of Ispahan, where it was known by the Persian name Marv. A drug called "Merw" was mentioned by Abu Mansur in 1055, and Seligmann refers it to *Origanum Marv*, L., a native of Syria. Aitchison, in his *Notes on the Products of Western Afghanistan*, mentions "Salvia (?)" as the origin of the nutlets known as *Kanoucha* or *Kanouncha*. (*Pharm. Journ.*, March. 11, 1893.)

Influence of Menthol on the gastric functions.*

Following Professor I. T. Tchüdnovsky's suggestion, Dr. Vladimirsky has carried out a set of experiments on seven healthy subjects (six men, including himself, and one woman), aged from 24 to 32, the drug being administered with food, in the dose of 0·3, 1·0 and 20 grammes. The author has arrived at the following conclusions:—

(1) The drug (in any of the doses stated) very markedly diminishes the proportion of free hydrochloric acid in the gastric juice, the decrease attaining its maximum in about 1 or 1½ hours after the ingestion.

* *St. Petersburg Inaugural Dissertation*, 1891, No. 77, p. 44; *Medical Chronicle*, August, p. 367.

(2) In persons presenting a more or less weakened motor power of the stomach, the decrease lasts longer than in those with a normal one.

(3) The digestive power of the gastric juice is diminished.

(4) The transformation of proteids into peptones is retarded (hence an increased proportion of propeptones, *i.e.*, intermediary products of peptonisation).

(5) The proportion of lactic acid in the gastric juice is augmented, the rise proceeding parallelly with diminution in the proportion of free hydrochloric acid.

(6) The motor power of the stomach grows weaker (in about one hour after the ingestion); in initial stages of the digestion, however, it may occasionally undergo some increase.

(7) The absorptive power of the organ improves, which seems to be dependent upon a favourable (stimulating) influence of menthol on the circulation.

(8) Contrary to the statements of Ossendowski (*vide* the *Journal of Laryngology and Rhynology*, May, 1890, p. 202), L. Braddon, M. Reichert, S. Rosenberg, Hugo Koster, and many other observers, menthol does not appear to possess any special "appetite-making" power.

(9) In 1 and 2 gramme doses, the remedy gives rise to a kind of intoxication, followed, in 4 or 5 hours, by sensations of languor and drowsiness.

(10) Menthol may prove useful as a substitute for camphor. (*By Nikolai A. Vladimirsky.*)

Ustukhadus and Gul-i-sirwaj.

We have received from Afghanistan, under the name of *Ustukhudus* (Stæchas), the flowering tops of a labiate plant which appears to be a *Moluccella*; it has enlarged purple calices and Balm-like odour.

In the same parcel we received, under the name of *Gul-i-sirwaj*, the large rose-coloured calices of *Hymenocrater elegans*, Bunge, containing the ripe nutlets; the calices have an agreeable aromatic odour and are mucilaginous.

ARISTOLOCHIACEÆ.

Aristolochine and Aristin.

These two substances have been obtained from the roots of *Aristolochia argentina* by Dr. O. Hesse, who gives the following account of them (*Pharm. Journ.*, Jan. 9th, 1892):—

The powdered root gives a dark brown yellow colour to ether, and when gaseous ammonia is added to the ethereal solution a red flocculent precipitate is separated. The ether solution separated from this precipitate gives on evaporation a yellowish-brown residue, in which clear, colourless crystals are formed after some time. The dark-coloured mass separated from these crystals and again dissolved in ether gives, on shaking with dilute sulphuric acid, a small quantity of a base. The greater part of it, however, remains in the root that has been treated with ether, and can be extracted with alcohol. On evaporating the alcoholic extract a brownish-yellow resinous residue is obtained that is partly dissolved by caustic soda solution and gives up the base to ether.

I propose to apply the name Aristin to the substance contained in the above-mentioned red ammoniacal compound. When that compound is dissolved in hot glacial acetic acid, the aristin crystallizes out on cooling, and it can easily be obtained in a pure state by recrystallizing from hot glacial acetic acid. Aristin forms shining gold-coloured laminæ and flat needles sparingly soluble in hot glacial acetic acid and scarcely at all soluble in the cold. It is sparingly soluble in hot alcohol, more so in ether, chloroform, or benzene.

At about 260° C. it blackens, but does not melt until the temperature reaches 270° C., and then undergoes decomposition. It dissolves in concentrated nitric acid on boiling for a short time, and separates again unaltered on cooling; but when the boiling is long continued decomposition takes place with evolution of red vapour. Aristin dissolves in acetic anhydride with a yellow colour, and when concentrated sulphuric acid is dropped into the solution it becomes at first intensely blue and then permanently greenish-blue. The alcoholic solution of aristin has a perfectly neutral reaction, but the substance combines with ammonia and with soda. These compounds have a fine red colour, and the ammonia compound can be crystallized from alcohol in delicate needles. Both compounds are dissolved by water or

alcohol with deep orange-red coloration. On addition of acids to these solutions a flocculent yellow precipitate is thrown down which soon becomes crystalline.

The second of the above-mentioned compounds is a fat acid ester that can be easily purified by recrystallization from alcohol. It takes the form of small white laminæ which melt at 84° C., and are very soluble in hot alcohol, but sparingly in cold alcohol, very soluble in ether, pertroleum spirit or chloroform, and insoluble in water.

The substance dissolves in hot glacial acetic acid, and on cooling crystallizes out again unaltered. In the alcoholic solution this substance can be easily saponified, the products being phytosterin and palmitic acid.

The third substance mentioned above is a base, to which I propose giving the name Aristolochine. That name has already been applied by Chevallier to a bitter substance obtained from *Aristolochia serpentaria*, but it was obviously a mixture the bitter taste of which was probably due to the presence of the base now described. Therefore, the name seems to me to have been inappropriate in that instance, and I have transferred it to the pure substance.

Aristolochine is precipitated from its colourless solutions in sulphuric or acetic acid on the addition of ammonia or caustic soda in the form of white amorphous flocks. It is freely soluble in alcohol, ether, chloroform, or benzene. On evaporating the ether solution it remains as a colourless resinous mass. When the ether solution is mixed with an equal volume of petroleum spirit and the mixture very slowly evaporated, warty masses are deposited that are distinctly crystalline. The base has a bitter taste and neutralizes acid perfectly. The hydiodide and sulphocyanide are amorphous oily precipitates which present no tendency to crystallize. The platinochloride is a dark yellow and the aurochloride a pale yellow amorphous precipitate; both are almost insoluble in water.

The behaviour of the base with concentrated sulphuric acid is remarkable. It forms a fine green solution, which becomes bright bluish-green on the addition of a trace of ferric chloride. Similar reactions are given by aricine, cusconine, and some of the bases of the bark of *Remijia purdieana*.

Aristolochine appears to have been already observed by Dymock and Warden in their examination of *Aristolochia indica*, and I am of opinion that the differences of their statements in regard to the base

are solely due to their having failed to separate it completely from colouring material. I am also of opinion that aristin partakes of the nature of the yellow substance* obtained by previous observers, and that, according to some remarks of Dymock and Warden, it is probably present in the root of *Aristolochia indica.*

Aristolochin is the name given by Dr. J. Pohl to the active principle of the seeds of *Aristolochia Clematitis* and the roots of *A. rotunda* and *A. longa.* The powdered drugs were exhausted with petroleum-ether, which removed chlorophyll, oil, and a gelatinous, nitrogenous, inactive substance (occasionally this can be obtained crystalline); warm 96 per cent. alcohol removed the colouring and bitter principles; after evaporating to syrupy consistence it was taken up with water and acidulated with sulphuric acid, the precipitate collected, expressed, dried at 40° C., and extracted in a Soxhlet apparatus for some weeks with petroleum-ether until the last traces of the above-mentioned nitrogenous substance were removed and the residue exhausted with alcohol or ether; from this alcoholic or ethereal solution there separated after a time yellow crystalline masses, which, recrystallized several times from ethereal solution, were found to constitute the active principle. It is soluble in chloroform, ether, acetone, phenol, acetic anhydride, aniline, and alcohol; almost insoluble in cold water, slightly soluble in warm water; insoluble in pertroleum-ether, benzol, and carbon disulphide; alkalies and alkaline-earth hydrates dissolve it; from neutral or alkaline solutions it is precipitated by neutral and basic lead acetate, dialyzed iron, zinc sulphate, silver nitrate, and a saturated solution of salt, but not by alum, copper sulphate, and platinic chloride; it does not reduce Fehling's solution and does not react with Millon's reagent. Its ultimate analysis, C 59·98, H 3·54, N 4·32, O 32·16, leads to the formula $C^{32}H^{22}N^{2}O^{13}$. Physiologically it was found that cold-blooded animals were entirely indifferent to it; while in warm-blooded animals uræmic intoxication was produced; in this respect aristolochin is a much more powerful agent than any other substance; it resembles aloin in its action upon the kidneys, but is about ten times more poisonous—it is probable that given to man it may act as a cathartic (*Arch. f. exper. Pathol. u. Pharm.*). (*Apoth. Ztg.* 1891,642.)

* See *Pharm. Journ.*, li., 245.

LAURINEÆ.

Gum-barks.

Gum-bark, or *Pishin-puttai* of the Tamils, does not refer to the bark of a tree which exudes a gum by bruising or incision, but denotes a bark which has such mucilaginous properties that it could be used for special purposes in medicine and the arts, where the white of egg would be used elsewhere. Barks of this description occur in the natural orders Malvaceæ and Laurineæ, and students of materia medica know that drugs of these orders, marsh-mallow root, and the barks of arboreous cinnamons, for instance, contain a peculiar mucilage, which is not precipitated by alcohol. A typical gum-bark of the East is that of *Kydia calycina*, a malvaceous tree, growing extensively on the slopes of the Nilgiris, and largely employed in sugar refinery under the Tamil name of *Kadularangy-puttai*. On soaking a portion of this dried bark in water it rapidly swells, and the inside becomes coated with a slimy mucilage. The inner layers of the liber may then be removed like pieces of lace, and the gum is seen to be occupying the spaces between the longitudinally disposed fibres, apparently formed from the cellulose of the broken cell-walls. The bark of Kydia is sold in the bazaars, and the decoction is taken as an astringent and tonic, and the Vythians or native doctors consider it to be a specific for diabetes.

Dr. Mohideen Sheriff, in the "Supplement to the Pharmacopœia of India," gives *Tetranthera Roxburghii* as the botanical origin of *Pishin-puttai*, but offers no description of the drug under that heading. Mr. Hollingsworth, of the Madras Medical College, some time ago supplied me with an authentic specimen of the bark of *Tetranthera laurifolia*, or, as it is now called in the "Flora of British India," *Litsæa sebifera*. The bark was of a reddish-brown colour and slightly balsamic odour, very different to that of cassia or cinnamon. The thickness was a quarter of an inch, and when soaked in water it became very mucilaginous. It afforded, on analysis, distinct reactions for an alkaloid, which had the characters of laurotetanine, a poisonous base lately discovered by Dr. Greshoff in the barks of several species of Javanese lauraceous plants.

About two years ago a collection of drugs for identification was sent to me by Dr. P. S. Mootooswamy, of Tanjore, and among them was a specimen of *Pishin-puttai*, which, he said, was collected from trees growing in the jungles near Point Calimere. This bark

had a most agreeable odour, resembling, but not identical with, Indian cassia, and the taste was decidedly sweet. It made a slimy mucilage when mixed with water and contained some tannic acid, but no alkaloid resembling laurotetanine could be separated from it. The bark is sold in the bazaars, and it is known as *Mydalakady* among Muhammadans. It is used in medicine for its mucilaginous, demulcent, and refrigerant properties. By powdering the bark with some benzoin, mixing it into a paste with a little water, and smearing this on reeds, and drying them in the sun, flavouring sticks called *Samboorany-vathe* are made, and are burnt as an incense or perfume. I have not been able to obtain the botanical source of this particular variety of gum-bark, but I am inclined to believe from its odour that it is an arboreous cinnamon.

From Travancore I have received on different occasions three specimens of gum-bark, all varying the one from the other. The first was a thick, red-coloured bark, a commercial article on the Western Coast, supplied to sugar refiners. The botanical origin could not be ascertained; it differed in physical characters from the barks previously mentioned, and yielded an alkaloid having the reactions of laurotetanine. Probably it was a Litsæa. The second description of gum-bark was that of *Kydia calycina*. The third specimen was sent by the Conservator of Forests for Travancore; it was named in Malyalum *Ava-tholi*, and derived, it was supposed, from a species of Cordia.

I have recently examined some samples of gum-barks from the Madura District of Southern India, and stated to be used by the hill villagers in increasing the alcoholic strength of sago toddy. The plants yielding these barks were up to this time only known by their vernacular names, but as leaves, flowers, and fruits were also sent, these enabled them to be identified. The request was also made that they should be analysed to ascertain the nature and effect of their use in native spirit manufacture.

The seven specimens of bark were as follows :—

1. Kadaly-marum* ... ... *Olea glandulifera.*
2. Koppa-marum ... ... *Litsæa Zeylanica.*
3. Karukathan-gundu* ... *Hiptage Madablota.*
4. Mullu-gundu ... .. *Jasminum flexile.*
5. Pungala-marum ... ... *Ligustrum Roxburghii.*
6. Sudala-marum ... ... *Litsæa Wightiana.*
7. Kumala-marum ... ... *Gmelina arborea.*

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* Marum = tree, gundu = climber (Tamil).

The *Olea glandulifera* is a stout, tall tree, with white flowers and small black fruit. The bark is of a greyish colour, with whitish specks, about $\frac{1}{6}$ of an inch in thickness, breaking with a close granulated fracture, inner surface brown.

The *Litsæa Zeylanica* is a moderate-sized tree, with yellowish-white flowers and black fruit; the leaves are ribbed and whitish on the under surface. The bark is gray and covered with lichens, smooth, $\frac{1}{6}$ of an inch thick, fracture close, showing white, glistening fibres running through the red substance of the middle and inner layers, brown and smooth internally. The bark gives off a fragrant odour when burning.

The *Hiptage Madablota* is a woody climber, reaching to the top of trees over 100 feet high. The stems are from half to three-quarters of an inch in thickness, and covered with a thin, smooth, reddish-brown bark enclosing a yellowish wood.

The *Jasminum flexile* is also a climber. The stems are about one inch in diameter, very woody and knotted, covered with a light yellowish-brown papery bark, exfoliating on the surface.

The *Ligustrum Roxburghii* is a stout tree about 50 feet in height. The bark is coloured russet-brown, and is a quarter of an inch or more in thickness; fracture close, showing thick white fibres running through the brown middle and inner layers.

The *Litsæa Wightiana* is similar to *L. Zeylanica* in many respects. The bark has a greyish-green epidermis, beneath which is a chocolate-coloured surface; the fracture is short and light coloured, becoming red or brown by exposure to the air.

The *Gmelina arborea* is a common tree in the plains. The bark is about half an inch thick, with a rugged, black and yellowish-brown surface, middle layer hard and brown, fracture granular, ochreous within.

Some documents accompanying these specimens stated that the barks of these trees were used "to increase the intoxicating effects of sago toddy." The bark is simply placed in the toddy and left there for two or three days. The bark No. 3, it is said, is not so frequently used, as the resulting liquor causes headache when drunk. With reference to No. 7, it was said that a tenth part of it would answer the purpose in the absence of other barks.

It will only be necessary to give the results of the chemical examination of these barks, in so far as they are likely to explain

their action in the fermentation of sugar. Three of the plants curiously enough belong to the natural order Oleaceæ; these are *Olea glandulifera*, jasminum and ligustrum, and like other plants of this order contain a peculiar bitter principle, soluble in water and alcohol, and a yellow colouring matter called quercetin. Two other barks of the series belong to the same natural family of the laurels, and have a similar composition; these are the Litsæas. The Hiptage bark contains tannin, and is simply an astringent; and the Gmelina belongs to a class of plants distinguished for their bitterness.

The amount of extract dissolved out of the bark by water and alcohol respectively were determined in order to ascertain their relative proportion, as it would seem that in the absence of much resin, the excess of water extract over the spirit extract would indicate mucilaginous matter, and on the barks being placed in the toddy, which in a fresh state is a watery solution of sugar, with some albuminous matter, the extract would dissolve, but as fermentation proceeded, alcohol would be formed and the mucilage would become insoluble and precipitate, carrying down with it the viscid albumen, and thus allow the sugar to ferment more rapidly. From the fact that other gum-barks besides the Litsæas, such as *Kydia calycina* and *Guazuma tomentosa*, are largely used in clarifying sugar, it is evident that some such object as this is intended in their employment. The astringent qualities of most of the above-mentioned barks are no doubt used for the purpose of forming insoluble compounds with albuminous matter in saccharine solutions; just as hops are used to remove this substance from malt liquor in the ordinary process of brewing beer. The hops are found to prevent in a great measure the tendency of the beer to become sour, in consequence of the conversion of alcohol into acetic acid, and in warm climates where such liquors are apt to run into the acetous fermentation very rapidly, it is necessary to employ astringent drugs to regulate the formation of alcohol and prevent the development of acetic acid.

The natives consider these barks a necessary ingredient in making spirit, for the following reasons: Firstly, they diminish the great sweetness of the toddy sugar. Secondly, they render the spirit more intoxicating. The first of these phenomena is accounted for by the chemical fact that sugar breaks up during fermentation into two other bodies, alcohol and carbonic acid; and in the second place the barks enable the operator to obtain a larger proportion of alcohol from

his toddy than he could get from leaving it to brew without such adjuncts. The analyses of the barks, with the exception of the Litsæas, which contain laurotetanine, has revealed no principle of poisonous or intoxicating properties, therefore the idea of their directly communicating a potency to the spirit is not sufficiently established, and, besides, as the spirituous liquor is submitted to distillation afterwards, any alkaloid, such as strychnine, would be left behind in the retort. Some of the barks are aromatic, and these most likely are used to flavour the resulting spirit, which would be the case if the aroma resided in a volatile oil. It is probably a spirit of this kind that Dr. Ainslie refers to under the title of *Puttaicharagum*, or bark-spirit, an alcoholic liquor in which barks of various acacias are used in the manufacture. (*D. H.*)

Formosa Camphor.*

Formosa camphor is obtained from the *Laurus camphora*, immense forests of which extend over most of the lower ranges of hills in the island, extending up the lower slopes of the mountains inhabited by the savage tribes. Many of these forests have not been touched, and the statement that the camphor supplies in South Formosa are becoming exhausted, applies only to those districts which are purely Chinese. The supply from other parts is practically inexhaustible. Even in purely Chinese districts it is only at certain places that the supply is falling off in consequence of the reckless manner in which the trees have been destroyed, partly for the sake of the timber and camphor, and partly, no doubt, simply to clear the ground for cultivation.

It has been often stated that the method of obtaining crude camphor in Formosa is by steeping the chopped branches in water, and boiling until the camphor begins to adhere to the stick used for stirring, when the liquor is strained, and by standing the camphor concretes. By this method it does not necessarily follow that the tree is destroyed; in fact, with a little care there is no need that it should be. But although this method may have been in use in former days, it certainly is not now. On the contrary, I am assured by several natives, engaged in the trade, whom I have questioned on the subject, that the yield of camphor from the branches is too small to repay the labour of extraction.

* From a report by Mr. Consul Warren on the trade of Tainan, Formosa.

The method in general use now is as follows:—The camphor expert selects a tree and scrapes into the trunk in different places, using an instrument somewhat resembling a rake, with the view of ascertaining whether it contains sufficient camphor to repay the labour of extraction. A tree is said not to be worth anything for camphor purposes until it is fifty years' old, and the yield is very unequal; sometimes one side only of the tree contains enough camphor to satisfy the expert, and in this case that side alone is attacked. The trunk is scraped to as great a height as the workmen can conveniently reach, and the scrapings are pounded up and boiled with water in an iron vessel over which an earthenware jar, specially made for the purpose, is inverted. The camphor sublimes and condenses on the jar, which is removed from time to time, scraped, and replaced. The root of the tree and the trunk, for some eight feet up, contain, as a rule, the greatest quantity of camphor. If the scrapings obtained from the trunk yield well, the chipping is continued until in the end the tree falls. The roots are then grubbed up, as it is certain they will give a proportionately good return. If, however, the scrapings do not turn out well, the tree is abandoned, and work is commenced on another. No attempt is made to extract camphor from the fallen trunk or from the branches. In some cases, the trunk is sawn up into timber, but this depends on the locality; from many districts, owing to absence of roads, timber would not pay for its transport.

It is impossible to imagine a more wasteful method of procedure, and it is fortunate that the camphor forests of Formosa are practically inexhaustible.

The quantity of camphor produced depends, of course, simply on the amount of labour employed in the business. Ten of the iron pots mentioned above and their accompanying jars make up what is called a "set," and are worked by four men. One set will produce about 65 lbs. in ten days, or, say, 1¾ cwt. a month, but this only under the most favourable circumstances; a fair average is about 1½ cwt.

Recently a change has been made in the camphor monopoly. It is now proposed by the Chinese authorities that the camphor stills should be licensed before they are permitted to work. The cost of the license will be equivalent to a tax of about 22*s*. 6*d*. per cwt., a heavy tax, seeing that the actual value of the camphor at the

place of production is very little over this amount. (*Pharm. Journ.* June 13th, 1891.)

EUPHORBIACEÆ.

Phyllanthus Niruri.

The bitter principle of this plant, which we provisionally named *pseudo-chiratan*, has been examined by M. Ottow (*Nederl. Tijds. voor Pharm.*, 1891, 3, 128), who calls it *phyllanthin* and gives its chemical composition as $C^{30}H^{37}O^{8}$. It crystallizes in colourless needles or flakes, possesses an intensely bitter taste, and is almost insoluble in water, but easily soluble in alcohol, petroleum ether, ether, chloroform, benzene, and glacial acetic acid. At 200° C. it is volatilized and condenses in the upper part of the vessel as an amorphous mass, but in a few days this amorphous deposit changes to the crystalline state.

Manioc or Cassava.

From the brief allusions to this substance by writers on Materia Medica, one would get but a slight idea of its importance as an article of diet in tropical countries, being the staple-food for unnumbered millions of human beings—the staff of life in the West Indies, Brazil, and on the Continent of Africa.

The plant from which this food is derived is known to botanists as *Janipha Manihot*, and is a shrub six to twelve feet high and one or two inches in diameter. Except for the young leaves, which are used as greens, its whole value consists in its tuberous roots, which sometimes reach the enormous weight of thirty pounds, but usually range from one to three inches in diameter and from six to eighteen inches in length. The shrub is said to be a native of Brazil, where it is known as Mandioca or Tapioca. Cassada (or Cassava) is its name in the West Indies. It is not grown from the seeds, but from cuttings, having surprising vitality; for a cane of it, like Aaron's rod, will bud and grow leaves in your hand. Hence, it is only necessary to cut the stick into pieces of six to twelve inches in length, and thrust them into the ground, and it matters little whether the ground has been first broken for it or not. In eight to eighteen months the tubers are in their best state to produce the nutritious food—seventy per cent. gluten and thirty of starch; but, at a later period, the gluten becomes

less and the starch increases. There is no food-product which compares with it in resisting drought. Even in the dryest seasons, it is like other trees "planted by the rivers of water," and whole fields are green with its foliage, while all else is brown with the scorching sun.

There are two varieties of the manioc, known as the sweet and the bitter; the first of which may be eaten with impunity, while the latter has a bitterish, milky juice, which is poisonous from containing prussic acid. But these roots are grated or otherwise reduced to a pomace, and then suspended in grass bags, when the poisonous juice drips out, or, being volatile, is dissipated by the heat in baking bread from it. The bitter variety is the principal kind used in British Guiana, while the sweet is the one mostly cultivated in Africa. The tapioca which comes into our houses is almost pure starch, and is made from the expressed juice of the root, which, on standing, deposits in the form of powder, and which, if dried without heat, will remain so. If heat be applied, it takes the form of the irregular masses we are accustomed to see.

The root has the taste of chestnuts, and may be eaten raw. It is delicious, wholesome food when roasted in hot embers or broiled. If soaked till the skin can be drawn off and the fibrous heart drawn out and then dried, it makes good bread; or, if broken up and fried in palm oil and salted, it is a good relish, and the Africans call it *bomba*.

An extremely white and fine flour, called *fuba*, is made from the soaked and dried roots, and it is the chief food in Angola.

The flour makes a thick porridge or mush—*funje*. The water is boiled and salted and set off the fire; after which *fuba* is stirred in until it can be cut into blocks, which may be taken in the hands and eaten with molasses or dipped into chicken broth.

The staff of life on the Congo is *quanga*, or bread made from the manioc by soaking, peeling, and pounding the soaked root into a pomace, and kneading and making into dough-loaves of four by six or ten inches. These loaves are wrapped in thin, tough leaves and bound, and then boiled in large earthen pots. Then the bread is ready for use; or it may be sliced and browned or broiled, as one prefers.

Farina from the manioc is prepared by grating the green root, drying in the sun, with all the starch and tapioca in it, browning it slowly over the fire; after which it is eaten by stirring it into soup or boiled beans.

9c

Grate, strain, and dry slowly in the sun, and you have a starch for puddings or any other purpose for which starch has demand in the market. Gluten being a nerve-food, indispensable to health and vigour of both body and mind, the great abundance of it in the Cassada—nearly three times as much as in wheat flour—the Cassada is pre-eminently "the staff of life," since there is no way by which its abundance of gluten can be wasted in preparation, as in wheat. There is a Providence here which shapes ends, since this chief food for tropical regions has so much nerve-supplying elements and so little of the heating elements, as compared with food in colder climates.

But this abundant gluten, as compared with other foods for the sick, pre-eminently fits it for the sick-room, and especially so when we wish to increase strength instead of heat, and where any irritating and indigestible food-substances are forbidden. It requires longer boiling than starchy foods in general, and may be use . in the form of thin mucilage or demulcent, or in a more solid form with sugar, lemon juice, nutmeg or other aromatics. I suspect that, as physicians, we should make immense gain in restoring from prostrating sicknesses by using more of this eligible substance in place of so much meat slops, and especially so in cases complicated with more or less gastric irritation. Meat foods must be excluded from the stomach in gastric ulcer. Why not, then, fall back upon this highly nitrogenous food for supporting the strength? Having so large a proportion of gluten over the starch, it offers immense advantages over wheaten and other bread in cases of diabetes where any starch at all is allowable. (*By E. Chenery, M.D., of Boston, "The Times and Register,"* April 5th, p. 318.)

In the Cox's Bazar district, Bengal, the tuberous roots are used by the Maghs in the preparation of a spirit.

A false Kamala.

Mr. Henry G. Greenish has examined a sample of Kamala from Bombay, and found it to have been carelessly collected, and mixed with badly preserved safflower and other extraneous matter, and reduced to coarse powder. (*Pharm. Journ.*, March 11th, 1893.)

PHARMACOGRAPHIA INDICA.

INDEX

AND

APPENDIX

TO THE

PHARMACOGRAPHIA INDICA,

BY

WILLIAM DYMOCK,

BRIGADE-SURGEON, RETIRED,

LATE PRINCIPAL MEDICAL STOREKEEPER, BOMBAY,

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SURGEON-MAJOR, BENGAL ARMY,
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PHARMACOGRAPHIA INDICA.

A

HISTORY

OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN

MET WITH IN

BRITISH INDIA,

BY

WILLIAM DYMOCK,

BRIGADE-SURGEON, RETIRED,

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Dr. William Dymock.

In issuing the sixth part of the "Pharmacographia Indica," *it is* with much regret we have to announce the death of the senior author. This sad event, caused by influenza combined with cystitis, took place on the 30th April 1892, at his residence on Malabar Hill, Bombay, in the fifty-eighth year of his age. William Dymock belonged to the west of England, and was educated first at Bristol, then at Rugby, and afterwards at Oxford where he took a B.A. degree. After a course of medical studies, he became M.R.C.S. Eng., he then joined *the Indian* Medical Service, and was appointed to the Bombay Presidency in 1857. He saw active service during the Mutiny with the Kathiawar Field Force against the Wagheers, and was present at the capture of Dantal Hill. For two years he was attached to the Indian Navy, and visited the ports of the Persian Gulf and the East African Coast. In 1868 he served on the Committee for publishing the Pharmacopœia of India, and at the time he was Acting Resident Surgeon at the European General Hospital. After taking two years' furlough to England he was appointed in 1871 to be Principal of the Medical Store Department, Bombay, and in this capacity he laboured for nearly twenty years, until his retirement from the service on 30th April 1890. During this time he devoted all his energies to the study of materia medica and pharmacy. He largely increased the local manufacture of galenical preparations, and introduced modern and improved machinery in the Depôt laboratory. For his skilful and efficient management he was thanked by Government on three separate occasions. Dr. Dymock was proficient in Arabic, Persian, Sanskrit, Hindustani, Mahratti and Guzrati; he was familiar with Greek and Latin, and corresponded freely in French, German and Portuguese. He was a Fellow and Examiner of

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the University of Bombay, and being an eminent linguist he was for many years a member of the Presidency Board for the examination of officers in Oriental languages. Bombay being the drug market of the East, he availed himself of the many opportunities of examining new and rare vegetable products, and having a good knowledge of botany, he was often able to identify the sources of the drugs. He was for some years Professor of Materia Medica in the Grant Medical College, and, as a teacher of this science, he was said not to have a rival in India.

Dr. Dymock's literary contributions to the *Pharmaceutical Journal* commenced in 1875 with a paper on "The Asafœtidas of the Bombay Market," this was followed by others on "Ammoniacum and Dorema Root," "Myrrh" and "Chaulmoogra Oil." In 1876, the well-known "Notes on Indian Drugs" first appeared, and were a feature of the Journal for the next four years. Specimens of these drugs were at the same time liberally supplied to the Pharmaceutical Society's Museum, and were sent to pharmacologists in England and the Continent for chemical investigation. In 1883 he brought out his "Vegetable Materia Medica of Western India," and this was amplified into a second edition only two years afterwards. The publication of a more comprehensive work on Indian Materia Medica, based on the same plan, was conceived in 1888, and next year the first part of the "Pharmacographia Indica" was issued. The greater responsibility of this work rested with him, and to it he gave his whole time until his fatal illness compelled him to cease from his labours a few days before he died. The manuscript of the sixth part, as far as he could prepare it, was written, and he compiled an index and an appendix which will be printed as soon as possible.

Dr. Dymock was one of the founders of the Anthropological Society of Bombay, and most actively supported the Society in the successive positions of member of the Council, President (1889), and General and Literary Secretary. The subject of his Presidential address was, "India as a field for Anthropological Research," and among his papers read at the meetings were

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"Anthropogonic Trees," "On the Narcotics and Spices of the East," "The Flowers of the Hindu Poets," On the use of Turmeric in Hindu Ceremonial" and "On the use of Ganja and Bhang in the East." He also read papers before the Bombay Natural History Society and the Medical and Physical Society. He was honorary member of the Pharmaceutical and other learned societies. In 1887 he was awarded the Hanbury Gold Medal for his researches in the natural history and chemistry of drugs.

As a scientific investigator Dr. Dymock was thorough and conscientious; in his literary researches he was careful and painstaking; his disposition was kind and obliging. Although a man of varied and great talents he was of very retiring habits, and had very few social acquaintances. His subordinates regarded him as a father, and his correspondents in different parts of the world could always count upon a punctual and friendly reply to their enquiries. He was the greatest pharmacognoscist in this country, and many besides ourselves will mourn that such a useful career was so suddenly terminated.

C. J. H. WARDEN.

DAVID HOOPER.

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PHARMACOGRAPHIA INDICA.

SCROPHULARINEÆ.

VERBASCUM THAPSUS, *Linn.*

Fig.—*Eng. Bot.* viii., *t.* 549; *Woodv. Med. Bot.*, *t.* 125. Great Mullein (*Eng.*), Bouillon blanc, Molène (*Fr.*).

Hab.—Temperate Himalaya. Westwards to Britain. The root, leaves, and flowers.

Vernacular.—Phúlla, Ban-tambákú (*Hind.*).

History, Uses, &c.—The Hindi names for this plant are well chosen: Phúlla signifies "covered with flowers" and Ban-tambákú "wild tobacco." As far as we know it is not mentioned by Sanskrit medical writers. The Arabians describe it under the names of Adán-ed-dubb, "bear's-ear," and Mahizah-raj, "fish poison"; it is also called Sikrán-el-hut, "fishes' hemlock," and in modern Arabic, Labidat-el-baida, "white felt plant," and Busir.

Mahizahreh and Busir are Persian names for Mullein, which is described very exactly by Haji Zein in the Ikhtiárát.

Mahometan physicians consider it to be hot and dry in the third degree, and prescribe it in gout and rheumatism in combination with aperients. They identify it with the φλόμος or φλομίς of the Greeks of which several kinds are described by Dioscorides as useful in diarrhœa and cough, and externally as an emollient; one kind, φλομίς λυχνιτις, was used for making lamp wicks. The narcotic action of Mullein on fish appears to

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be well known to the Arabs and Persians. According to Dr. Stewart, the roots are used in Northern India as a febrifuge.

In Europe Mullein has long had a reputation in the pulmonary diseases of cattle, on which account it bears the name of *Cow's Lungwort*. In Germany the plant is placed in granaries to drive away mice. The stalks covered with pitch were formerly used as flambeaux, from this practice the plant derived its names of *Cierge de Notre-Dame* and *Fleur de grand Chandelier* in France, and *High Taper* in England. The leaves and flowers are considered to be demulcent, diuretic, anodyne, and antispasmodic, and have long been in use in diarrhœa and pulmonary affections. An infusion of the flowers is used in France as a diuretic, and a cataplasm of the leaves as an emollient. The seeds are said to be narcotic, and to have been used in asthma and infantile convulsions. In 1883 Dr. F. J. B. Quinlan (*Brit. Med. Journ.*) drew attention to the popular use of the leaves boiled in milk as a remedy for phthisical cough and diarrhœa in Ireland, and stated that the plant was cultivated in gardens on rather an extensive scale. He claims for it weight-increasing and curative powers similar to those possessed by cod liver oil.

Description.—The root-leaves are from 6 to 18 inches in length, the cauline oblong, the upper ones being acuminate and sessile on the stem, more or less crenate, thickly covered with soft, whitish, stellate hairs. They have a mucilaginous somewhat bitter taste, and a disagreeable odour when fresh, which is lost on drying.

The flowers form a spike 6 to 10 inches in length, the corolla only is collected. It is from ½ to ¾ inch in diameter, bright yellow, 5-lobed, smooth above, and stellately tomentose beneath; attached to the tube are the stamens, of which the three upper are woolly, and the two lower longer and smooth. The taste is mucilaginous and somewhat bitter. The plant described by Haji Zein appears to be *V. Blattaria*, as he says that the flowers have a purple eye. The odour of the flowers has been compared with that of orris root.

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The seeds are about $\frac{1}{25}$ of an inch in length, cone-shaped, finely pitted, very tough and difficult to powder, nearly inodorous, and have a somewhat acrid taste.

Chemical composition.—Morin (*Journ. Chim. Med. ii.*, p. 223) obtained from the flowers a yellow volatile oil, a fatty acid, free malic and phosphoric acids, malate and phosphate of lime, acetate of potash, uncrystallizable sugar, gum, chlorophyll, and a yellow resinous colouring matter.

Adolph Latin submitted the leaves to proximate analysis and found the constituents to be 0·80 per cent. of a crystalline wax, a trace of volatile oil, 0·78 per cent. of resin soluble in ether, 1·00 per cent. of resin insoluble in ether, but soluble in absolute alcohol, a small quantity of tannin, a bitter principle, sugar, mucilage, &c. The moisture in the air-dried sample amounted to 5·90 per cent., and the ash to 12·60 per cent. He concludes that the plant contains many of the usual constituents, and a bitter principle which may be prepared by exhausting the drug with alcohol, dissolving the alcoholic extract in water and agitating with ether or chloroform. Several trials failed to secure this substance in a crystalline condition. It was found to be soluble in water, ether, alcohol, and chloroform, and to possess a decidedly bitter taste. It responded to none of the tests for a glucoside or alkaloid. (*Am. Journ. Pharm.*, Feb. 1890. E. L. Janson (1890) found that petroleum ether and stronger ether used successively, extracted from the flowers about $\frac{1}{2}$ per cent. in each case. A decided change in the colour of the drug was noticed after the extraction with ether, which removed the yellow colour, leaving the residue of a dark green. The yellow colouring matter was either a part of, or else it was retained by, the resin dissolved by ether, and it was not found possible to separate it in the pure state. The drug after exhaustion with ether yielded 10·06 per cent. to absolute alcohol. A considerable portion of this alcoholic extract was soluble in water acidified with hydrochloric acid. When agitated with petroleum ether the acid solution yielded some colour to it, and this latter solvent on evaporation left a greenish-brown crystalline mass of a strong disagreeable odour and a sweet taste, which proved to be an easily decomposable glucoside. Another

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crystalline extractive was obtained by making the above acid solution of the alcoholic extract alkaline and agitating with ether; while chloroform subsequently extracted a red-brown amorphous mass.

Both of these extractives reduced Fehling's solution, and many changes in colour were noticed, indicating that these substances take some part in the colouring matter of the flowers.

The drug was also found to contain 2·49 per cent. of mucilage, 11·76 per cent. of carbohydrate corresponding to dextrin, 5·48 per cent. of glucose, 1·29 per cent. of saccharose, 16·76 per cent. of moisture, 4·11 per cent. of ash, and 32·75 per cent. of cellulose and lignin. No reaction indicating tannin was obtained with iron salts, but an aqueous solution of the alcoholic extract yielded a slight precipitate with gelatin. The seeds yielded to petroleum ether 20·75 per cent. of a bright green fixed oil. The acrid principle was obtained from the alcoholic extract soluble in water by agitating with petroleum ether. The moisture was 10·86 per cent., and the ash 3·90 per cent. (*Amer. Journ. Pharm.*, Dec. 1890.)

Celsia coromandeliana, *Vahl., Wight Ic., t.* 1406, is an annual plant having the characters of Verbascum, which is common in many parts of India in the cold weather, usually appearing in fields or in the beds of rivers. It has much the same medicinal properties as *Verbascum Thapsus,* and has been brought to notice by Dr. B. M. Chatterjee as a sedative and astringent in diarrhœa. (*Phar. of Ind.*, p. 161.) The plant is slightly bitter and abounds in mucilage. The natives usually express the juice (*ang-ras*) and administer it in ounce-doses as a cooling medicine in fever, skin eruptions, dysentery, and such diseases as they consider to be due to heat of blood.

The plant is herbaceous, pubescent, and viscid; lower leaves lyrate, floral cordate, stem clasping; peduncles longer than the calyx; calycine segments ovate, slightly toothed, or oblong-lanceolate, entire; flowers largish, yellow; filaments bearded with purple hairs.

The Sanskrit name is Kuláhala; in Bengal it is known as Kukshima, and in the Deccan as Kutaki.

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SCHWEINFURTHIA SPHÆROCARPA, *A. Braun.*

Fig.—*Burm. Fl. Ind., t.* 39, *f.* 2; *Wight Ic., t.* 1459.

Hab.—Sind, Biluchistan, Afghanistan. The herb in fruit.

Vernacular.—Sannipát (*Ind. Bazars*).

History, Uses, &c.—In Hindu medical literature and in popular use, *San-nipáta* is a term which signifies a combined derangement of the three humors, Váta, Pitta, and Kafa (air, bile, and phlegm), which is supposed to produce *Sannipáta-jvara*, or fever with typhoid symptoms. The remedy for this condition is said to be a plant called Sannipáta-nud, "driving away sannipát," and Nepála-nimba, "Nepal Neem" or "Nepal bitter." At the present time the drug sold in the shops is *S. sphærocarpa*, but whether it is the original Nepal Neem is difficult to decide, as at present we do not even know whether this plant is found in Nepal. In typhoid conditions the drug is considered to act as a tonic, to promote diuresis, subdue fever, and remove the derangement of the humors. We are not aware of any experiments having been made with it by European physicians in India, though its near relationship with the Antirrhinums, which contain glucosides similar to those of Digitalis, would, we should have thought, have excited curiosity in regard to its physiological action.

Description.—The drug consists of the plant in fruit, broken up into small pieces. The fruit is a globular dry papery mucronate capsule, firmly attached to the calyx; the upper part of the capsule to which the placenta is attached is double; the placenta, which is large and oblong, is supported upon a thick peduncle, and occupies the centre of the capsule; to it are attached numerous straight 5-angled wedge-shaped seeds, which are packed closely together and fill the remaining space. The calyx is 5-partite, the upper segment very large and extending over the fruit like a hood. Leaves ovate, leathery, about 1 inch long with short blunt hairs; margin much lighter in colour than the rest of the leaf; seed straight, wedge-shaped, with six

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prominent longitudinal ridges; testa tubercular, each tubercle minutely granular. The portions of stem, which are numerous, are woody and covered by a thin grey bark; the central pith is very large. The drug has a slightly bitter somewhat tea-like taste.

Chemical composition.—The powdered drug treated with ether yielded a dark olive-green extract, consisting of chlorophyll and uncrystallizable fatty matter. Subsequent percolation with alcohol removed a deep brown extract, from which cubical crystals of alkaline chlorides separated on evaporation. An aqueous solution of this extract had a saltish taste and gave distinct precipitates with alkaloidal tests. The alkaloid was removed by ether in an amorphous condition, and gave no well-marked colour reactions with the strong mineral acids. By continuing the exhaustion of the powdered drug with water, a deep reddish brown extract was obtained having a bitterish and nauseous taste, and containing saccharine and other matters which readily fermented. In order to ascertain if the drug contained a substance similar to digitalin, a fresh decoction of the powder was filtered and precipitated by tannin, the precipitate washed, mixed with an excess of alkali, and shaken with ether. The result was the separation of an alkaloid similar to that previously found. As more recent investigators prepare digitalin by exhausting with alcohol after treatment of the drug with water, this process was adopted with *Schweinfurthia.* The resinous matter collected had an acrid taste, but no principle could be obtained possessing the properties of digitalin, digitonin or digitoxin, to which, according to Schmiedeberg, the poisonous qualities of digitalis are due. Besides the alkaloid, which we consider to be the active principle, the drug yielded 18·6 per cent. of mineral matter.

Lindenbergia urticæfolia, *Lehm., Hook. Ic. Pl., t.* 875, is a common plant throughout India upon walls and banks; the juice is given in the Concan in chronic bronchitis, and mixed with that of the Coriander plant is applied to skin eruptions. It has a faint aromatic odour and a slightly bitter taste. The

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Marathi name in the neighbourhood of Bombay is *Dhol.* Roxburgh, under the name of *Stemodia ruderalis,* gives the following description of it :—" *Root* ramous, seems perennial. *Stems* many, ascending, ramous, herbaceous, woody, somewhat viscous, the whole plant about 12 or 18 inches high. *Leaves* opposite, petioled, ovate, deeply serrate, soft, a little hairy; about an inch long. *Petioles* shorter than the leaves, channelled. *Stipules* none. *Flowers* axillary, subsessile, solitary, opposite, small, yellow. *Calyx* 10-furrowed, 5-toothed, permanent. *Corol* personate; *tube* the length of the calyx; both lips projecting, and shut; apex of the under lip broad, depending, 3-toothed, of the upper one very narrow, bifid; inside of both hairy, and beautifully marked with small purple dots. *Filaments* and *anthers* as in the genus. *Stigma* slightly 2-lobed." (*Flora Indica,* III., 94.)

LIMNOPHILA GRATIOLOIDES, *Br.*

Fig.—*Rheede, Hort. Mal. ix., t.* 85, *and xii., t.* 36.

Hab.—Throughout India, in swamps. The plant.

Vernacular.—Kuttra (*Hind.*), Karpur (*Beng.*), Ambuli (*Mar.*), Mánga-nári (*Mal.*).

History, Uses, &c.—This small aquatic plant, in Sanskrit Ambu-ja, " water born," and Ámra-gandhaka, having an odour of mangoes," is considered to be antiseptic by the Hindus, and its juice is rubbed over the body in pestilent fevers. Rheede notices its use for this purpose, and also internally in dysentery combined with ginger, cumin, and other aromatics. He also states that a liniment is made from the plant with cocoanut oil which is used in elephantiasis. Roxburgh, under the name of *Columnea balsamea,* describes the plant and notices its grateful odour and aromatic taste. The Bengal name signifies " camphor." The odour of the fresh plant is remarkably refreshing and agreeable and calls to mind that of camphor and oil of lemons.

L. gratissima, *Rheede, Hort. Mal. x.,* 6, has similar properties and bears the same vernacular names; it is also used

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medicinally as a cooling medicine in fever, and given to women who are nursing when the milk is sour.

Description.—In its most common form a simple or branched plant 4—8 in. high, with whorled pinnatifid leaves $\frac{1}{4}$—$\frac{3}{4}$ in. long, which, in wetter places, appears to acquire a few emersed, opposite, entire leaves at the top of the stem, and numerous capillaceo-multifid ones at its base. The stems are stout or slender. Very small specimens from Rohilkund (Kuttra, Edgeworth) have very wiry simple stems 3 in. high, and capillary peduncles three times as long as the leaves; others have stout stems and peduncles, the latter shorter than the leaves. Calyx $\frac{1}{8}$—$\frac{1}{6}$ in. long, rarely larger. Corolla $\frac{1}{3}$ in., blue. (*Fl. Br. Ind.*)

HERPESTIS MONNIERA, *H. B. et K.*

Fig.—*Bot. Mag.*, *t.* 2557; *Roxb. Cor. Pl. ii.*, *t.* 178; *Rheede, Hort. Mal. x.*, *t.* 14. Gratiole de l'Inde (*Fr.*).

Hab.—Throughout India, in marshy ground. The herb.

Vernacular.—Sufed-chamni, Barambhi (*Hind.*), Dhop-chamni, Brihmi-sák (*Beng.*), Nir-brami, Bámba (*Mar.*), Nir-brami (*Tam.*), Sámbráni-aku, Sámbráni-chettu (*Tel.*).

History, Uses, &c.—Dutt states that this plant is the Brahmi of the native physicians of Calcutta, where it is considered to be a nervine tonic useful in insanity, epilepsy, fever, &c. It is certainly not the Brahmi of the Nighantas, but would appear to be the plant called Jala-brahmi or "Water Brahmi" by Sanskrit writers. Owing to a similarity in the names it has frequently been confounded with *Hydrocotyle asiatica,* which is the Brahmi or Brahmi-manduka of the Nighantas.

Ainslie says that in Southern India the *Gratiola Monniera* is considered diuretic and aperient, and useful in that sort of

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stoppage of urine which is accompanied with obstinate costiveness. Roxburgh mentions the use of the juice mixed with petroleum as an external remedy in rheumatism. These accounts do not agree with the properties ascribed to Brahmi by Sanskrit writers. Rheede says of it:—"Ex frequenti hujus plantæ usu, vaccarum ubera lacte turgent; sit et decoctum ex illa in lacte vaccino et recenti butyro, contra delirium temporibus inunguendum; Pipere, Calamo aromatico, Myrobalanis et aqua oryzæ trita et assumpta, vocem reddit sonoram." In Pondicherry it is considered to be aphrodisiac, and in Ceylon, under the name of *Loonoo-ureela*, it is prescribed in fevers.

Description.—Stems several, annual, creeping, round, jointed, smooth, succulent; leaves opposite, sessile, obovate, wedge-shaped, or oblong, smooth, entire, obtuse, fleshy, dotted with minute spots; peduncles axillary, alternate, solitary, round, smooth, shorter than the leaves, one-flowered; flowers blue; bracts 2-awled, pressing on the calyx laterally; calyx 5-leaved, the exterior three leaflets large, oblong, the two interior small, linear, all are concave, smooth, pointed and permanent, corol campanulate, border 5-partite, nearly equal; anthers 2-cleft at the base, blue; stigma large, somewhat 2-lobed; capsule ovate, 2-celled, 2-valved; seeds very numerous. (*Roxb.*, *Flora Ind.*, I., p. 141.)

Chemical composition.—For the analysis the whole plant was used, dried at a low temperature and exhausted with 80 per cent. alcohol. The alcohol freed extractive was then agitated with petroleum ether; ether from an acid solution, and again with ether from an alkaline solution, and finally with chloroform from an alkaline solution. Operating in this manner, a trace of oily matter was obtained, soluble in alcohol with acid reaction; two resins, one easily soluble in ether, the other soluble with difficulty, but both soluble in alkaline solutions and reprecipitated by acids; an organic acid, and a tannin affording a green coloration with ferric chloride. An alkaloidal principal was also isolated, soluble in ether and in chloroform, and affording a cherry red coloration in the cold with Fröhde's reagent. No other reactions were noted.

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PICRORHIZA KURROOA, *Benth.*

Fig.—*Royle Ill., t.* 71.

Hab.—Alpine Himalaya; from Cashmere to Sikkim. The root.

Vernacular.—Katki, Kutki (*Hind.*, *Beng.*), Katuku-rogani (*Tam.*), Katuku-roni (*Tel.*), Bál-kadu (*Mar.*), Kutaki (*Guz.*).

History, Uses, &c.—This well-known drug is the Kutaki of Sanskrit writers, who speak of it as Dhanvantari-grastá, "the plant eaten by Dhanvantari," the physician of the gods, who was produced at the churning of the Ocean, holding a cup of *amrita* in his hands; he was the author of the Ayurveda. In the Nighantas it bears the following synonyms: Rohini, Katu-rohini, Vakrágra, Matsya-pitta, Matsya-vinna, Kánda-ruha, Krishna-bhedi, Dvijángika, Asoka-rohini, Sáku-ládani and Chakránga. It is described as digestive, bitter, pungent, dry, aperient, light and cold; and is recommended as a remedy for worms, asthma, bile, phlegm, and fever. Kutaki is a favorite remedy in bilious dyspepsia accompanied by fever, and is given daily in decoction, with liquorice, raisins, and Neem bark, half a tola (90 grains) of each, water 32 tolas, boiled down to one-fourth. In dyspepsia and dysentery it is combined with aromatics and is given in doses of ten to twenty grains.

It is considered to be specially indicated in those cases in which the secretions are scanty and the bowels costive, and is often prescribed for children suffering from worms, whence the Marathi name Bálakadu, "children's bitter."

Chakradatta states that about two drachms of the powdered root given with sugar and warm water act as a gentle aperient. Mahometan writers give Katki or Kutki as an Indian synonym for black Hellebore, and unmistakably describe the latter plant and its medicinal properties. This mistake has misled most European writers upon Indian drugs, but Ainslie, though he describes the drug in his article upon black Hellebore

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(*Mat. Ind.*, I., p. 164), has the following remarks:—"I have given the names *Kadagoroganie* and *Kali-kootkie* as the Tamool and Dukhanie appellations of the black Hellebore, as the root procured in the Indian bazars is commonly said to be so; but I have great doubts of it, and I here offer a caution respecting it, as it by no means agrees in appearance with the black Hellebore of the European shops."

Royle (*Ill. i.*, p. 291) notices that the root of *P. Kurrooa* possesses much bitterness and is employed medicinally by the natives. Irvine (*Mat. Med.*, p. 58) mentions the use of Kutki as a tonic, but owing to a general impression that the bazar drug was Hellebore root, European medical men appear to have generally avoided making experiments with it. Mr. Moodin Sheriff was the first modern writer to clearly demonstrate that the bazar drug has no dangerous properties, but is a valuable tonic and antiperiodic. He also identified it with the *P. Kurrooa* of Royle, an identification which we are now able to confirm through the kindness of Mr. J. F. Duthie who has supplied us with a specimen of the plant collected in Kumaon. As regards the medicinal properties of the drug, the accounts given by Sanskrit writers appear to be correct. Mr. M. Sheriff speaks favourably of it as a powerful bitter tonic and antiperiodic. Other medical men in India have expressed a similar opinion, and we can state from personal observation that it is used successfully as an antiperiodic in native practice; its slight laxative action is rather beneficial than otherwise. The dose as a tonic is from 10 to 20 grains, as an antiperiodic from 40 to 50 grains; it is best administered in combination with aromatics.

Description.—The drug consists of a rhizome, generally about the size of a goose-quill, but often no larger than a crow-quill, the lower portion of which is covered by a shrivelled, greyish-brown, corky bark, and marked by prominent scars, the remains of rootlets; towards the upper end it becomes larger (¼ inch in diameter), and is thickly set with dark greyish-brown scales, and terminates in a scaly leaf-bud or stem. The rhizome is generally broken into short pieces, from 1 to 2

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inches long; the fracture is short, the root very fragile and light, and black internally; it has no odour, and a very bitter taste.

Microscopic structure.—The corky bark is made up of numerous rows of empty brick-shaped cells; within this is a cellular parenchyma of oblong brown cells, containing a little granular matter; next a dark brown line composed of wood cells, forming the boundary of the inner column of the root; within this several very large bundles of dotted vessels arranged so as to form a broken ring, which surrounds a central cellular parenchyma.

Chemical composition.—A proximate analysis of this drug showed the following percentage composition:—

Wax	1·06
Bitter principle (Picrorhizin)	14·96
Picrorhizetin	3·85
Organic acid ppt. by lead	3·54
Glucose	11·53
Cathartic acid, &c. (water extract)	9·33
Substances dissolved by NaHO	7·62
Arabin bodies from crude fibre	14·56
Fibre	24·00
Moisture	5·73
Ash	3·82

The bitter principle is a glucoside *Picrorhizin*, freely soluble in water and alcohol, but almost insoluble in pure ether. It is acid in reaction, is not precipitated from solution by lead salts or tannin, but is absorbed by animal charcoal together with any colouring matter that is present. It is best obtained by exhausting the powdered drug with crude ether, and is left, after the evaporation of the ether, in brown resinoid drops which form ramified crystals on standing. It is difficult to obtain the picrorhizin in a crystalline condition after heating or after solution in water. Any wax removed by the crude ether can be separated from the dry extract by petroleum spirit, which has no solvent action on the bitter principle. The

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picrorhizin is decomposed by hydrolizing it with a boiling 1 per cent. solution of hydrochloric acid for three hours, and a decomposition product, which we have named *Picrorhizetin*, is formed together with glucose. In obtaining 0·7 gram of picrorhizetin ·368 gram separated during the first hour, ·219 gram in the second hour, ·113 gram in the third hour, and none in the fourth. Weighed quantities of the picrorhizin, after drying at 100°C., afforded, on hydrolysis, 62·48 and 62·79 per cent. of picrorhizetin, as the result of two experiments. The glucose obtained from the decomposition was inactive towards polarized light. An infusion or tincture of the root boiled with diluted acid gradually loses its bitterness, and a large increase in the sugar is detected by Fehling's solution. Picrorhizetin is a red-brown, brittle, resinous, tasteless body soluble in aqueous alkalies. It is insoluble in water, and its solution in alcohol is precipitated by ether. By heating with strong sulphuric acid or when being burnt it evolves an odour of benzoin.

The wax after bleaching, and purifying by recrystallization from hot alcohol, had a melting point of 51°C. The organic acid separated by lead was red-coloured and gave a greenish colour with ferric salts. No tannic acid was present. Some picrorhizetin was naturally formed in the drug, and existed in a much smaller proportion in the freshly dried rhizome. After removing the bitter principle by continued percolation with alcohol, the marc was dried and exhausted with water, the dark red-brown solution was evaporated to dryness, and ·2 gram of the residue was found to act as a decided purge. The aqueous extract treated with four volumes of alcohol afforded precipitates containing 14·5 and 15·3 per cent. of mineral matter, and with six volumes a precipitate was obtained with 10·8 per cent. of ash. We rely upon the physiological action of this extract in considering cathartic acid to be a constituent.

Commerce.—Value, Rs. 9 per maund of 37½ lbs. Kumaon annually exports about five tons of this drug.

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Plants of minor importance belonging to this order, which have a certain amount of medicinal reputation, are :—

Torenia asiatica, *Linn., Rheede, Hort. Mal. ix., t.* 53, the juice of which is given on the Malabar Coast for gonorrhœa.

Vandellia erecta, *Benth., Rheede, Hort. Mal. ix., t.* 57, called *Vaka-pushpi*, or "crane flower," in Marathi, is also used in a ghrita as a remedy for gonorrhœa, and the juice is given to children who pass green-coloured stools. **V. pedunculata,** *Benth. Griff. Ic. Pl. As., t.* 418, *f.* 2, in Marathi *Gadagvel*, is considered to have similar properties.

Veronica Beccabunga, *Linn. Reichb. Ic. Fl. Germ., t.* 1701, is used in Northern India under the name of *Tezak*, "cress," as a diuretic and antiscorbutic. It is the Bachbunge of the Germans, Cressonée of the French, and Brooklime of the English. **V. Anagallis,** *Linn. Reichb. Ic. Fl. Germ., t.* 1762, which has similar properties, takes its place in other parts of India.

Sopubia delphinifolia, *G. Don, Roxb. Cor. Pl. i., t.* 90, is an elegant annual, common in wet fields in the rainy season. The juice is applied by field labourers to their feet to heal sores caused by exposure to wet; it is astringent and stains the skin yellow at first but afterwards black. The plant was formerly named *Gerardia,* after John Gerarde, our old English botanist, and author of the "Herbal," published in 1597.

Pedicularis pectinata, *Wall.*, and several other species are used in Northern India under the name of *Mishran* on account of their astringent and hæmostatic properties.

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BIGNONIACEÆ.

OROXYLUM INDICUM, *Vent.*

Fig.—*Wight Ic., t.* 1337; *Bureau Monogr. Bign., t.* 9; *Rheede, Hort. Mal. i., t.* 43.

Hab.—Throughout India. The root-bark.

Vernacular.—Arlu, Phalphala, Sona (*Hind.*), Nasona, Sona (*Beng.*), Mulin, Tálpalang, Miringa (*Punj.*), Tetu, Jagdala (*Mar.*), Tetu (*Guz.*), Vanga adanthay (*Tam.*), Tigdu-mara, Sone-patta (*Can.*), Pamania, Dundillam (*Tel.*), Peiani (*Mal.*).

History, Uses, &c.—This is a small tree, remarkable for its terminal spikes of large fleshy lurid flowers, which appear at the commencement of the rainy season, and are followed by very large, retrofracted, transversely compressed, somewhat curved pods, with the convexity upwards. The seeds are numerous, membranaceous, surrounded with a large, delicate, membranaceous wing. The leaves are supra-decompound, and from four to six feet long. The root-bark is of considerable importance in Hindu medicine, as it is an ingredient of the Dasamula (see *Tribulus terrestris*); it is considered to be astringent, tonic, and useful in diarrhœa and dysentery. Sarangadhara recommends the juice of Syonaka expressed from the roasted bark in combination with Mocharas (see *Bombax malabaricum*) as a remedy in diarrhœa and dysentery. He also says that the root-bark boiled in Sesamum oil is a good application in otorrhœa. In the Nighantas the tree bears many synonyms, amongst which may be mentioned Prathu-simbih, "having broad pods," Súka-nasa, "having a nose like a parrot's beak," in allusion to the flower buds, Aralu, and Bhalluka-priya, "dear to bears." It is described as digestive, appetising, bitter, astringent, cold, pungent; a remedy for wind, phlegm, bile, and cough. The bark is much used by the agricultural classes as an application to the sore-backs of draught cattle. It is ground to a paste with water and an equal proportion of turmeric, and rubbed on the part. Rheede notices the use of the bark as an

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application to wounds, fractures, &c., and of the root in decoction in dropsy.

Dr. B. Evers states that the Gonds call the tree *Jaimangal*, and that they employ a decoction of the bark as a discutient application to rheumatic swellings. He says:—"I have made a trial of the powder and an infusion of the bark, and have found it to be most powerfully diaphoretic; the drug has slight anodyne properties; also a bath, prepared with the bark, I have frequently employed in rheumatism. Twenty-eight cases of acute rheumatism were treated with this drug, and in all the results have been most satisfactory. The dose of the powder is from 5 to 15 grains, thrice daily; of the infusion (1 ounce of bark to 10 ounces of boiling water) an ounce three times a day. Combined with opium it forms a much more powerful sudorific than the compound powder of ipecacuanha. The drug does not possess any febrifuge properties."—*Indian Medical Gazette*, February and March, 1875.

Description.—The bark of the root is brown externally, yellow internally, thick, breaking with a short fracture. That of the stem is soft and spongy externally, and of a pale brown colour, furrowed longitudinally; the internal surface is fibrous and greenish yellow. The minute structure does not call for remark, but upon placing a section of the fresh bark under the microscope in a little water the whole field is seen to be filled with delicate needle-shaped crystals which have escaped from the cut cells of the parenchyma; in entire cells the crystals, which are of an inorganic nature, can be seen *in situ*. The bark is faintly bitter and a little acrid; it has no particular odour.

Chemical composition.—The bark has been examined by W. A. H. Naylor and E. M. Chaplin with the following results:—

A. One pound of the bark reduced to fine powder was percolated to exhaustion with cold petroleum ether. The ether was distilled off, and the residue, which weighed about 1·8 gram, possessed the characters of a soft greenish-brown fat, having an acid reaction and a slightly acrid taste. It was treated successively with ether and proof spirit; the former removed

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vegetable wax, which was subsequently identified as such after re-solution in limited quantities of ether and separation therefrom. The latter on evaporation gave a brownish-yellow residue small in quantity and crystalline. When further purified by extraction with ether and the ethereal residue by benzol it was golden yellow, unctuous to the touch, and prononncedly acrid. Under the microscope it presented the appearance of long, wavy, branching crystals, which dissolved readily in alcohol, chloroform ether, petroleum ether, and benzol.

B. The marc was next percolated with cold ether. After distilling off the greater portion of the ether, and allowing the remainder to evaporate spontaneously, a yellow mass studded with minute interlacing crystals was obtained, which when air-dried weighed about 4 grams. This product was treated with boiling proof spirit and filtered while hot; on cooling small yellow crystals fell out of solution. When quite cold the crop of crystals was collected and subjected to the action of boiling petroleum ether until freed from every trace of fat. It was then cystallized from boiling proof spirit until it had a constant melting point, and was no longer contaminated with uncrystallizable matter. The resulting crystals were dried under the receiver of an air-pump, and when constant weighed 0·9 gram. They were of a lemon yellow colour, about ⅛ inch in length, and melted at 228·5°—229° C. Alcohol, ether, glacial acetic acid, and hot benzol dissolved them readily, but they were practically insoluble in water hot or cold. The following reactions in connection with this interesting body have been noted, of which the most striking is its behaviour with the caustic alkalies. A minute quantity brought into contact with one drop of a weak solution of sodium potassium or ammonium hydrates causes it to assume immediately a cherry-red colour, which quickly passes into brick-red and olive-green.

Owing to the insolubility of the crystals in water a proof spirit solution was used in applying the following tests:—

1. A solution of silver nitrate in proof spirit produced a bluish-black colour immediately, and after the liquid had stood

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for a few minutes black particles of reduced silver were precipitated.

2. A solution of neutral acetate of lead in proof spirit gave a light-red bulky precipitate insoluble in boiling acetic acid.

3. Lime water imparted an orange colour, which quickly changed to olive-green, followed by a precipitate of the same colour.

4. An aqueous solution of sulphate of copper gave a golden yellow colour, quickly followed by a dirty brown precipitate, the supernatant liquid being distinctly greenish.

5. Solution of ferric chloride (acid) produced a brownish-red colour, which, in a few minutes, turned smoke-colour.

6. Solution of subacetate of lead gave a golden yellow precipitate.

7. An aqueous solution of mercuric chloride produced a white precipitate.

8. An aqueous solution of permanganate of potash, acidified with sulphuric acid, was *instantly* decolorized.

9. A solution of the crystals in proof spirit did not reduce Fehling.

The authors say :—"We have attempted to hydrolyse this body, by subjecting a strong alcoholic solution to the prolonged action of 10 per cent. solution of sulphuric acid at a boiling temperature, but without success.

"We have also inquired into its nature and centesimal composition, but the results so far obtained are not sufficiently conclusive to be incorporated in this paper. We hope to be able to publish shortly a supplementary note dealing with points in process of investigation. Meanwhile, we propose that this interesting principle be designated *Oroxylin.*"

C. The marc left after exhaustion with petroleum spirit and ether was percolated with cold absolute alcohol. The residue resulting from the distillation of the spirit was treated with cold proof spirit, which took up the greater part of it. The insoluble portion dissolved readily in boiling proof spirit, and, on

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examination, proved to be largely composed of the yellow crystalline body oroxylin. The cold proof spirit solution of the alcoholic residue was evaporated to dryness and the extract treated with water and filtered. The filtrate was treated successively with neutral and basic acetate of lead, and the precipitates after washing were suspended in water, decomposed by a current of sulphuretted hydrogen and the resultant plumbic sulphide removed by filtration. Sulphuretted hydrogen was also passed through the filtrate from the basic or plumbic acetate and the precipitated lead sulphide removed by filtration.

The three liquids thus obtained, which for convenience may be denominated i., ii., iii., were then evaporated down and the respective residues examined.

(i.) It was dissolved in the smallest quantity possible of cold water and diluted with many times its volume of alcohol. After setting aside for twenty-four hours a precipitate fell, giving the general characters of parapectin. The supernatant liquid on evaporation left a scaly residue, astringent to the taste, and perfectly soluble in water. Its aqueous solution reduced Fehling and gave a copious bluish black precipitate with ferric chloride. Lime-water produced a bright golden-yellow colour, followed by a reddish-brown precipitate. From the tannins proper it differed in that it was not precipitated by solution of gelatine.

(ii.) This residue apparently consisted of pectin intermixed with small portions of No. iii.

(iii.) This was a dark uncrystallizable treacly-looking residue, which imparted to the palate a feeble sensation of sweetness. It was very soluble in water and reduced Fehling's solution abundantly. A strong aqueous solution was precipitated by absolute alcohol.

D. The marc from the alcoholic extraction was finally percolated to exhaustion with cold water. The liquor was evaporated down and the extract obtained taken up with hot water. A considerable amount of albuminous matter, which remained insoluble, was removed by filtration. The filtrate was treated

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successively with neutral and subacetate of lead and the precipitates decomposed in the same manner as described under C. The three liquids obtained, i., ii., iii., were evaporated down.

(i.) This residue was the smallest of the three. After standing for a considerable time some crystals were deposited, which on examination proved to be citric acid.

(ii.) Nothing of a crystalline nature was found in this residue. It appeared to consist chiefly of extractive matter.

(iii.) This residue after treatment with alcohol had the same characters and possessed the same properties as C. iii. It was not further examined.

The result of our examination of this bark may be summarized by stating the different principles which we have found—(1) crystalline fat; (2) wax; (3) acrid principle; (4) oroxylin; (5) chlorophyll; (6) pectinous substances; (7) Fehling-reducing principle; (8) astringent principle; (9) citric acid; (10) extractive matter.—*Pharm. Journ.*, Sept. 27, 1890.

STEREOSPERMUM SUAVEOLENS, *DC.*

Fig.—*Wight Ic., t.* 1342.

Hab.—Throughout the moister parts of India. The root-bark and flowers.

Vernacular.—Pád, Paral, Káshta-pátali (*Hind.*), Parul (*Beng.*), Kálgori, Pádri (*Mar.*), Pádri (*Tam.*), Kálgoru, Pádari (*Tel.*), Húdai, Pádri-gida (*Can.*), Pádri, Pandan (*Guz.*). The flowers, Madana-kama-pu (*South India*).

History, Uses, &c.—This tree is the Pátalá or Pâtali of Sanskrit writers, the flowers of which are said by the poets to so intoxicate the bee that he is unable to distinguish one flower from another. The tree is sacred to Durga, the wife of Siva. In the Nighantas it bears among other synonyms those of Káma-duti "Cupid's messenger," Madhu-duti "messenger of spring," Sthâli, Ambu-vásini, and Tamra-pushpa "red flowered." Pátala also signifies "light red" or "rose-coloured." It

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is described as cooling, sweet, diuretic, and tonic, and is recommended in dyspepsia, dropsy, cough, and heat of blood.

P. S. Mootoosawmy says that in Tanjore the flowers are taken in the form of a confection as an aphrodisiac. The flowers pounded with honey are said to stop troublesome hiccough, and the ashes of the bark are used in preparing alkaline ley and caustic pastes. The bark is in use throughout India from its being one of the ingredients in the Dasamula or "ten barks." (See *Tribulus terrestris.*) In parts of India where this tree is not found, various substitutes are allowed to be used. In Malabar and in the Concan *S. chelonoides*, DC., is used as Pádri. (See *Rheede, Hort. Mal. vi., t.* 25 ; *Ainslie, Mat. Ind. ii.*, p. 272.)

Description.—Trunk tolerably erect, though not straight. Bark ash-coloured, and somewhat scabrous. Leaves opposite, pinnate, with an odd one, from 12 to 24 inches long. Leaflets opposite, from two to four pairs, oval, with long bluntish, narrow points slightly serrate, having both sides downy while young, and when full grown not downy and feeling harsh ; the exterior pair and odd one about six inches long, by three or four broad; the inferior pair, or pairs, smaller. Petioles swelled at the base, roundish, when old scabrous. Panicles terminal, composed of a few spreading branchlets; the first and second pairs thereof opposite; the superior dichotomous, with a solitary pedicelled flower in the forks; all are downy, and somewhat viscid. Flowers large, of a dark, dull crimson colour, exquisitely fragrant. Calyx campanulate. Border 4-cleft; upper divisions with two minute points, outside a little villous. Corol, throat ample, woolly, convex above, flat and plaited beneath. Border, the upper divisions shorter, erect; the three inferior ones longer and projecting, with the margins of all much curled. Filaments 4, fertile, and between them a small sterile one. Anthers twin. Germ oblong, elevated on a glandular receptacle. Stigma 2-lobed. (*Roxburgh.*) Sir W. Jones gives the following description of the flowers:—Corolla externally light purple above, brownish purple below, hairy at its convexity ; internally dark yellow below, amethystine above, exquisitely fragrant; preferred

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by bees to all other flowers, and compared by the poets to the quiver of Kamadeva (the Indian Cupid).

Chemical composition.—An infusion of the dried flowers contained saccharine, mucilaginous and albuminous matters, but no alkaloid could be detected in either the aqueous or alcoholic extract. Ether removed a small quantity of a wax-like solid from the powdered corollas.

STEREOSPERMUM CHELONOIDES, *DC.*

Fig.—*Wight Ic.*, *t.* 1341; *Bedd. Fl. Sylv.*, *t.* 72; *Rheede, Hort. Mal. vi.*, 26. Favas da Cobre (*Port.*), Adderbonen (*Dutch*).

Hab.—Throughout the moister parts of India. The flowers, leaves, and root.

Vernacular.—Páder, Pádri (*Hind.*), Dharmara (*Beng.*), Pádal (*Mar.*), Pádri (*Tam.*, *Mal.*), Tagada (*Tel.*), Padrigida (*Can.*).

History, Uses, &c.—In the Concan and Malabar, where *S. suaveolens* is not found, this tree is used as the Pátalá of the Nighantas. Rheede says of it:—"Viscerum rigorem intolerabilem dispellit foliorum decoctum. Limonis hujusque commixti succi medentur maniæ. Corticis vero succus, cum fructu Peræ subactus, immodicum inhibet fluxum menstruum. Radicis cutis cum Calamo aromatico, zinzibere contrita, foliorumque Padri succo admixta exhibetur morsis à putrefaciente colubro, Malabaribus *Polenga* dicto." Ainslie (ii., 272) says:—"This pleasant tasted root, as well as the fragrant flowers of the tree, the Vytians prescribe in infusion as a cooling drink in fevers."

The tender fruit and flowers of *S. chelonoides* are used as vegetables by the natives of Western India.

Description.—Trunk straight, of a great height and thickness. Bark thick, scabrous, brown. Branches very numerous, the inferior horizontal above, gradually becoming more and

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more erect to the top; leaves opposite, pinnate, with an odd one, about twenty inches long; leaflets opposite, short petioled, generally four pair, the inferior smallest, obliquely oval, pointed, sometimes slightly notched about the margins, when young downy, afterwards smooth, about 4 inches long by two broad; petioles about 9 inches long, channelled, smooth; stipules none; panicles terminal, the larger ramifications decussate, the smaller or terminal 2-forked, with a sessile flower in the cleft; peduncles and pedicels round, covered with oblong grey scabrous specks; bracts small, caducous; flowers pretty large, yellow, very fragrant; calyx 5-notched; nectary, a yellow fleshy ring surrounding the base of the germ; filaments, there is a fifth sterile one between the lower pair; anthers double; stigma 2-cleft; silique very long, slender, twisted; receptacle of the seeds spongy, white, with alternate notches on the sides for the seeds to lodge in. (*Roxb., Fl. Ind.*, III., 106.)

STEREOSPERMUM XYLOCARPUM, *Wight.*

Fig.—*Wight Ic., t.* 1335-6; *Bedd. Fl. Sylv., t.* 70.

Hab.—Deccan Peninsula. The wood and tar.

Vernacular.—Kharsing (*Mar.*), Ghansing (*Can.*).

History, Uses, &c.—This tree is a native of the forests of Western India from Khandesh to Malabar. It was introduced by Dr. Andrew Berry into the Botanic Garden at Calcutta, and is minutely described by Roxburgh.

The natives by a rough process of the same nature as that by which tar is obtained from Pine wood, extract from the wood a thick fluid of the colour and consistence of Stockholm tar, which they use as a remedy for scaly eruptions on the skin. Two globular earthen pots are used, the upper contains the wood in small pieces; it has a perforated bottom and is fitted with a cover, and is luted to the mouth of the lower pot. Cowdung cakes are then piled up round the two pots and set fire to. Dr. Gibson appears to have been the first to draw attention to the use of this substance by the natives. From some trials

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which we have made with it, we conclude that its properties are similar to those of Pine tar.

Description.—The wood is hard, but easily split; when sawn across it presents a yellow resinous surface; sections examined with the microscope show that the yellow colour is due to a solid resinous deposit in the pitted vascular system. The tar has exactly the odour, colour, and consistence of Stockholm tar.

Heterophragma Roxburghii, *DC.*, *Roxb. Cor. Pl. ii.*, *t.* 145, yields a similar product. Its vernacular names are Waras (*Mar.*), Baro-kala-goru (*Tam.*), Bondagu (*Tel.*).

Dolichandrone Rheedii, *Seem.*, is the *Nir-pongelion* of Rheede (vi., 29), who states that the seeds with ginger and Pavetta root are administered in spasmodic affections, and that in Malabar a decoction of the bark is used for preserving fishing nets. He gives *Cornos das Diabos* as the Portuguese name and *Bocks hoorn* as the Dutch.

Dolichandrone falcata, *Seem. Bedd. Fl. Sylv.*, *t.* 71, a native of Oudh, Rajputana, Central and South India, has the reputation of being used to procure abortion, and the bark is, it is stated, used as a fish poison.

Dr. Lyon, Chemical Analyser to the Government of Bombay, found, however, no ill effects to follow the administration of a considerable quantity of a decoction of the bark to a small dog. (*Med. Juris. for India*, p. 216.) It is possible that the woody capsules, which are about a foot in length by ⅜ of an inch in diameter, and somewhat curved, may be used as abortion sticks.

CRESCENTIA CUJETE, *Linn.*

Fig.—*Jacq. Amb.*, *t.* 111; *Plumb. Gen.*, *t.* 109. Calabash tree (*Eng.*), Calebassier (*Fr.*).

Hab.—South America. Cultivated in India. The fruit.

Vernacular.—Kalabash (*Africa*).

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History, Uses, &c.—The Calabash tree introduced from South America is now pretty well known in India, and latterly we have observed the fruit being offered for sale by the herbalists for use as a pectoral in the form of a poultice of the pulp applied to the chest. In the West Indies a syrup is made from the pulp, which is much used in dysentery and as a pectoral. The tree has oblong cuneate, often obovate, entire, shining leaves, and flowers variegated with green, purple, red and yellow. The fruit is large, gourd-like and green; it varies much in size, being from 2 inches to a foot in diameter.

Dr. Peckolt, of Rio Janeiro, states that an alcoholic extract of the not quite ripe fruit in doses of 0·10 gram. acts as a mild aperient, and that 0·5 gram. proves strongly drastic, without griping or ill effects. As an application against erysipelas, the fresh pulp is boiled with water until it forms a black paste, to which vinegar is added and the whole boiled together and spread upon linen.

Corre and Lejanne state that in Western Africa the leaves, along with those of *Adansonia digitata*, are boiled and eaten, and the seeds are eaten roasted. The pulp of the fruit macerated in water is considered to be depurative, cooling, and febrifuge; it is applied to the head in headache caused by insolation and to burns: roasted in ashes it is mildly purgative and diuretic, according to P. Labat; in the Antilles, Chevalier has recommended it in dropsies.

Description.—Fruit ovoid or nearly round, with a hard, green, woody shell; very variable in size. It is filled with a white, slightly acid pulp, in which are contained the flattened, somewhat cordiform seeds.

Chemical composition.—A chemical examination of the fresh fruit pulp yielded a new organic acid, crystallizing in plates, to which the name '*crescentic acid*' has been given. It was obtained by exhausting with water an alcoholic extract of the pulp, treating the aqueous solution with lead acetate, suspending the lead precipitate in water and decomposing and

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removing the lead, then evaporating to a syrupy consistence and leaving it to crystallize in a cool place. Besides crescentic acid, there were found tartaric, citric and tannic acids, two resins, a bitter and an aromatic extractive substance, and a colouring matter that appeared to resemble indigo. (*Peckolt, Pharm. Rundschau*, Aug. 1884; *Year Book of Pharm.*, 1885, p. 168.)

PEDALINEÆ.

SESAMUM INDICUM, *DC.*

Fig.—*Wight Ill., t.* 163; *Bot. Mag., t.* 1688; *Bentl. and Trim., t.* 198. Sesame (*Eng.*), Sésame de l'Inde (*Fr.*).

Hab.—Throughout the warmer parts of India, cultivated. The leaves, seeds, and oil.

Vernacular.—Til (*Hind., Beng.*), Ellu (*Tam.*), Nuvvulu (*Tel.*), Ellu, Kárellu (*Mal.*), Yellu (*Can.*), Mothetil (*Mar.*), Tal (*Guz.*).

History, Uses, &c.—In Hindu mythology Sesamum seed is symbolic of immortality. According to the "Brahma-purana," Tila was created by Yama, the "king of death," after prolonged penance. The Grihyasutra of Ásvaláyana directs that in funeral ceremonies in honour of the dead, Sesamum seeds be placed in the three sacrificial vessels containing Kusa grass and holy water, with the following prayer: "O Tila, sacred to Soma, created by the gods during the Gosava (the cow-sacrifice, not now permitted), used by the ancients in sacrifice, gladden the dead, these worlds and us!" Sesamum seeds with rice and honey are used in preparing the funereal cakes called Pindas, which are offered to the Manes in the Śraddh ceremony by the Sapindas "or relations" of the deceased.

On certain festivals six acts are performed with Sesamum seeds, as an expiatory ceremony of great efficacy, by which the

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Hindus hope to obtain delivery from sin, poverty, and other evils, and secure a place in Indra's heaven. These acts are, *tilodvarti*, "bathing in water containing the seeds"; *tilasnayi*, "anointing the body with the pounded seeds"; *tilahomi*, "making a burnt offering of the seeds"; *tilaprada*, "offering the seeds to the dead"; *tilabhuj*, "eating the seeds"; and *tilavápi*, "throwing out the seeds." Water and Sesamum seeds are offered to the Manes of the deceased. In the first act of Sakuntala this practice (called *Til-anjli*) is alluded to by the anchorite's daughter in love with King Dushyanta, when she tells her companions that if they do not give their assistance, they will soon have to offer her water and Sesamum seeds. (*De Gubernatis.*) In proverbial language a grain of Sesamum signifies the least quantity of anything—*Til chor so bajjar chor*, "who steals a grain will steal a sack"; *Til til ka hisab*, "to exact the uttermost farthing."

A worthless person is compared to wild Sesamum (Jartila, *Sans.*) which yields no oil—*In tilon men tel nahin*, "there is no good in him." Dutt remarks:—"The word Taila, the Sanskrit for oil, is derived from Tila; it would therefore seem that Sesamum oil was one of the first, if not the first oil manufactured from oil-seeds by the ancient Hindus. The Bhávaprakása describes three varieties of Til seeds, namely, black, white, and red. Of these the black is regarded as the best suited for medicinal use; it yields also the largest quantity of oil. White Til is of intermediate quality. Til of red or other colours is said to be inferior and unfit for medicinal use. Sesamum seeds are used as an article of diet, being made into confectionery with sugar or ground into meal. Sesamum oil forms the basis of most of the fragrant or scented oils used by the natives for inunction before bathing, and of the medicated oils prepared with various vegetable drugs. It is preferred for these purposes from the circumstance of its being little liable to turn rancid or thick, and from its possessing no strong taste or odour of its own. Sesamum seeds are considered emollient, nourishing, tonic, diuretic, and lactagogue. They are said to be especially serviceable in piles, by regulating the bowels and removing constipation. A

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poultice made of the seeds is applied to ulcers. Both the seeds and the oil are used as demulcents in dysentery and urinary diseases in combination with other medicines of their class." (*Mat. Med. of the Hindus*, p. 216.)

Mahometan writers describe the seed under the Arabic name of Simsim. In Africa it is called Juljulán,* and in Persia Kunjad. The Mahometan bakers always sprinkle the seeds upon their bread, the sweetmeat-makers mix them with their sweets. The following Delhi street-cry indicates the properties attributed to them by the latter class of people:—

"Til, tikhur, tisi, dána,
Ghi, shakkar meñ sána,
Kháë buddha, hoe javána."

"Sesamum, tikhur, and linseed,
Butter and sugar, poppy seed,
Old men it makes quite young with speed." (*Fallon.*)

The oil, which is called in Arabic Duhn-el-hal, is used for the same purpose as olive oil is in Europe. Sesamum is considered fattening, emollient, and laxative. In decoction it is said to be emmenagogue; the same preparation sweetened with sugar is prescribed in cough; a compound decoction with linseed is used as an aphrodisiac; a plaster made of the ground seeds is applied to burns, scalds, &c.; a lotion made from the leaves is used as a hair-wash, and is supposed to promote the growth of the hair and make it black; a decoction of the root is said to have the same properties; a powder made from the roasted and decorticated seed is called Ráhishi in Arabic and

* جلجلان That which is جليل (a thing) great in estimation. (Ibn Abbád in Táj-el-Arús.)

(*2nd*)—The fruit of Coriander. (Siháh, Mughrib, Kámús.)

(*3rd*)—Sesame. (Siháh, Ez-Zamakhsherí, Mughrib, Táj-el-Arús.) Sesame in its husk before it is reaped. (Siháh.) The grain of Sesame. (Kámús.)

(*4th*)—The heart's core. *Lane, Madd-el-Kamús.* The name Simsim is applied by the Arabs in the present day to *S. indicum*, but formerly signified the seed of another plant called by the Persians *Jilbahang* and *Zardkhár*, and having purgative properties like hellebore.

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Arwah-i-Kunjad in Persian; it is used as an emollient, both externally and internally.

Sesamum (σήσαμον) is frequently mentioned by Greek and Latin authors. Lucian (*Pisc.* 41) speaks of a σησαμαῖος πλαχους: this was probably similar to the *til ka laddu* of India.

Sesame oil was an export from Sind to Europe, by way of the Red Sea, in the days of Pliny. In the Middle Ages the plant was known as Suseman or Sempsen, a corruption of the Arabic Simsin or Samsim. It is now called by Europeans, both in India and Europe, *Jinjili*, *Jugeoline*, *Gigeri*, *Gengeli*, or *Gingelly*, which appear to be corruptions of the word Juljulán. The oil is one of the most valuable of Indian vegetable oils; it keeps for a long time without becoming rancid, and is produced in large quantities in almost every part of the Peninsula. The following mode of preparation is described in the Jury reports of the Madras Exhibition:—"The method sometimes adopted is that of throwing the fresh seeds, without any cleansing process, into the common mill, and expressing in the usual way. The oil thus becomes mixed with a large portion of the colouring matter of the epidermis of the seed, and is neither so pleasant to the eye nor so agreeable to the taste as that obtained by first repeatedly washing the seeds in cold water, or by boiling them for a short time, until the whole of the reddish-brown colouring matter is removed and the seeds have become perfectly white. They are then dried in the sun, and the oil expressed as usual. The process yields from 40 to 44 per cent. of a very pale straw-coloured sweet-smelling oil, an excellent substitute for olive oil."

Hydraulic presses are now in use in the more civilized parts of India for extracting the oil, but have as yet by no means superseded the native oil mill.

Sesamum oil may be used for plaster-making, but it takes more oxide of lead than groundnut oil, and does not make so light-coloured or so hard a plaster. After a prolonged trial at the Government Medical Store Department in Bombay, its use was abandoned in favour of the latter oil for the following

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reasons:—The rolls of Sesame oil plaster soften in hot weather. The plaster has a disagreeable odour. It darkens in colour when kept for any time. For liniments and ointments, except Ung. Hydr. Nitratis, it appears to be a perfectly satisfactory substitute for olive oil. F. H. Alcock (*Pharm. Journ.* [3], xv., 282) recommends its use in making Lin. Ammoniæ B. P. Sesame or Benne leaves, preferably in the fresh state, are much used in America as a demulcent in disorders of the bowels; they yield an abundant mucilage.

Description.—Annual, 2 to 3 feet; leaves opposite or upper ones alternate, ovate, oblong or lanceolate, the lower ones often 3-lobed, or 3-divided, feather-nerved; at the base of the peduncles are remarkable yellow glands; flowers solitary in the axils, resembling those of the fox-glove, from dirty white to rose-coloured, capsule velvetty and pubescent, mucronate, at first 2-celled, afterwards 4-celled; seeds numerous, without wings, ovoid, flat, white, brown, or black, rather smaller than linseed.

Chemical composition.—The following table shows the relative composition of the brown or Levantine, and yellowish or Indian, seeds:—

	Levantine.	Indian.
Oil	55·63	50·84
Organic matter	30·95	35·25
Ash	7·52	6·85
Water	3·90	7·06

the albuminoids being equal to 21·42 and 22·30 per cent. respectively in the two varieties.

In the manufacture of the oil the seeds are generally pressed three times: twice cold and the third time warm. In Calcutta, where the seeds are only pressed twice, the average yield is—

1st pressing of fine oil..............36 per cent.
2nd „ „ ordinary oil.........11 „

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The oil-cake has the following composition :—

Water	8·25	
Fat	7·63	
Non-nitrogenous matter	40·90	
Albumenoids containing 5·25 per cent. nitrogen	32·82	
Ash	10·40	(*Brannt.*)

For further information on Sesame oil we would refer the reader to Vol. II. of Allen's *Commercial Organic Analysis*, and to Brannt's work on *Oils and Fats*. The authors of the *Pharmacographia* say :—" The oil is a mixture of olein, stearin, and other compounds of glycerin with acids of the fatty series. We prepared with it in the usual way a lead plaster, and treated the latter with ether in order to remove the oleate of lead. The solution was then decomposed by sulphuretted hydrogen evaporated and exposed to hyponitric vapours. By this process we obtained 72·6 per cent. of Elaidic acid. The specimen of Sesame oil prepared by ourselves, consequently, contained 76·0 per cent. of olein, inasmuch as it must be supposed to be present in the form of triolein. In commercial oils the amount of olein is certainly not constant.

" As to the solid part of the oil, we succeeded in removing fatty acids, freely melting after repeated crystallizations at 67° C., which may consist of stearic acid mixed with one or more of the allied homologous acids as palmitic and myristic. By precipitating with acetate of magnesium, as proposed by Heintz, we finally isolated acids melting at 52·5 to 53°, 62 to 63°, and 69·2° C., which correspond to myristic, palmitic, and stearic acids.

" The small proportion of solid matter which separates from the oil on congelation cannot be removed by pressure, for even at many degrees below the freezing point it remains as a soft magma ; in this respect Sesame oil differs from that of olive.

" Sesame oil contains an extremely small quantity of a substance, perhaps resinoid, which has not yet been isolated. It may be obtained in solution by repeatedly shaking five volumes

of the oil with one of glacial acetic acid. If a cold mixture of equal weights of sulphuric and nitric acids is added in like volume, the acetic solution acquires a greenish yellow hue. The same experiment being made with spirit of wine substituted for acetic acid, the mixture assumes a blue colour, quickly changing to greenish yellow. The oil itself being gently shaken with sulphuric and nitric acids takes a fine green hue, as shown in 1852 by Behrens, who at the same time pointed out that no other oil exhibits this reaction. It takes place even with the bleached and perfectly colourless oil. Sesame oil added to other oils, if to a larger extent than 10 per cent., may be recognised by this test. The reaction ought to be observed with small quantities, say 1 gram. of the oil and 1 gram. of the acid mixture previously cooled."

J. F. Tocher recommends the use of hydrochloric acid with a little pyrogallol for detecting the presence of Sesame oil; 14 parts of the acid and 1 part of pyrogallol are to be placed with an equal proportion of the oil to be tested in a test tube, which is corked and well shaken. The tube is then to be allowed to stand for five minutes, when, the upper layer of oil having been removed by a pipette, the acid solution is boiled for five minutes. If Sesame oil is present, it will show a purple colour when viewed by transmitted light, and a blue colour by reflected light; the latter colour is best observed when the fluid is poured into a porcelain capsule. After a time a slight blue precipitate is thrown down. Olive oil tested with this re-agent afforded a faint yellowish colour, almond, groundnut and rape oils no colour, and cotton-seed oil a very pale red. An admixture of 1 to 2 per cent. of Sesame oil with olive oil may thus be detected.

The substance obtained by Flückiger on shaking Sesame oil with acetic acid has also been investigated by Tocher; he found it to be best obtained by using 7 volumes of acetic acid to 10 volumes of oil. After removal of the acid a brown transparent gelatinous residue was left, which, upon agitation with weak potash solution and rest for twelve hours, afforded a deposit, which, after being well washed with distilled water, was boiled

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with hydrochloric acid, collected on a filter, thoroughly washed to free it from acid, and dried over a water bath. It was then soluble in alcohol and crystallized on cooling from its alcoholic solution in long needles melting at 117—118° C. The needles were soluble in benzene, oil of turpentine, bisulphide of carbon, chloroform, and glacial acetic acid, but insoluble in water, alkaline solutions, and hydrochloric acid. They were neutral to test paper, and gave no colour reaction with the hydrochloric acid and pyrogallol solution, showing that this reaction is due to another principle in the oil which has not yet been isolated. (*Pharm. Journ.*, Jan. 24th, 1891.)

Sesame oil extracted by ether has a sp. gr. of 0·919 at 23° C.

Commerce.—Sesamum is commonly cultivated in India; there are two varieties, the black-seeded and the white-seeded; the former being generally known as *til*, and the latter as *tili*. *Til* ripens rather later than *tili*, and is more commonly grown, mixed with high crops, such as *Sorghum vulgare*, while *tili* does best when mixed with cotton. *Tili* oil is preferred of the two for human consumption. (*Duthie and Fuller.*)

The quantity of seed shipped from British India in the year 1871-72 was 565,854 cwts., of which France took no less than 495,414 cwts. In 1881-82, the exports from Bombay alone were 994,120 cwts., valued at Rs. 64,84,475. France continued to take about 4-6ths of the total exports. Besides this, 105,344 gals. of oil, value Rs. 1,12,122, were exported to Eastern ports. In 1884-85, the exports from the whole of India were 2,654 thousand cwts., and in 1887-88, 137 thousand tons, but in 1888-89 the exports fell to 77 thousand tons. This fall was probably due to an unfavourable season. No statistics of the consumption of the oil in India are available. It must be enormous, as Sesame oil is the food oil of all who can afford it.

PEDALIUM MUREX, *Linn.*

Fig.—*Burm. Fl. Ind., t.* 45, *f.* 2; *Gärtn. Fruct. i., t.* 58; *Wight Ic., t.* 1615; *Rheede Hort. Mal. x.*, 72.

Hab.—Deccan Peninsula, Ceylon. The leaves and fruit.

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Vernacular.—Bara-gokhru (*Hind.*, *Beng.*), Peru-nerunji (*Tam.*), Pedda-palleru (*Tel.*), Káttu-nerinnil (*Mal.*), Anne-galu-gida (*Can.*), Kadva-gokhru (*Guz.*), Karonta, Ubha-gokhru, Malvi-gokhru (*Mar.*).

History, Uses, &c.—This plant does not appear to have been used medicinally by the ancient Hindus, nor do we know of any Sanskrit name for it. It is supposed by Dr. Moodin Sheriff to be the Faríd-búti (herb Faríd), the plant upon which Shaik Faríd-ed-dín Shakar Ganj,* a Mahometan ascetic and poet, sustained life while he acquired the everlasting treasure of knowledge (Ganj-i-la-yazál-i-maárif). The following quatrain is attributed to him:—

Shabníst keh khún-i-dil-i-ghamnák naríkht. |
  Rúzí neh keh ábrú-i-man pák naríkht, ||
Yak sharbat-i-áb-i-khúsh nakhúrdam hameh 'umr. |
  Kán níz z'rah-i-dídeh bar khák naríkht. ||

By night I am consumed with grief,
  By day I am overwhelmed with shame,
No drop of sweet water passes my lips,
  But it pours in tears from my eyes.

P. Murex is the Caca-mullu of Rheede, who states that the powdered leaves are given in two-drachm doses with milk and sugar in gonorrhœa and gonorrhœal rheumatism. The fresh plant agitated in water or milk renders it gelatinous without materially altering its taste, colour or odour. This thickening disappears after some hours. A watery infusion of this kind sweetened with sugar is a favourite and excellent demulcent in acute gonorrhœa. The dried fruit is the Bara-gokhru or "great Gokhru" of the shops, and a decoction of it is used when the fresh plant is not obtainable. In the Concan a *Paushtik*, or "strengthening medicine," is made of the

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* Shakarganj or "sugar store." Poison in his mouth became sugar—

سنگ در دست او گوہر گردید .·. زہر درکام او شکر گردید

His shrine is at Pák-pattan, or the Ferry of the Pure; he died A. H. 664, ninety-five years of age. Pák-pattan is in the Panjáb, between Bahwalpúr and Firúzpur, in the Sutlej Valley.

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powdered fruit with *ghi*, sugar, and spices; it is taken with milk.

Dr. Emerson has observed that the juice is used as a local application to aphthæ.

P. Murex must not be confounded with the great Gokhru or Hasak of Mahometan medical writers, which is *Xanthium Strumarium*.

European writers upon Indian drugs bear evidence to the correctness of the native estimate of the medicinal value of Gokhru, and it has lately been introduced into European practice as a remedy for nocturnal seminal emissions, incontinence of urine and impotence. (*Practitioner*, XVII., 381.) It has been given in an infusion of 1 oz. of the fruit to 1 pint of boiling distilled water, this quantity being taken daily.

Description.—A spreading, low succulent plant with oval, dentate, obtusely pointed leaves; pedicels axillary, 1-flowered, shorter than the petiole, 1 to 2, or more dark-brown glandular bodies situated near the axils; flowers yellow; tube of corolla about 1 inch long; fruit pendulous, about ½ an inch long, and ¼ inch in diameter at the base, 4-angled, with a straight spine at the base of each angular ridge; above the spines is a narrow portion which is inserted into the 5-clawed calyx; when dry the fruit is corky, it is divided into two cells; the seeds are elongated, narrow, and four in number. The young branches, petioles, under-surface of leaves and immature capsules have a frosted appearance, which is due to the presence of numerous small, sessile, brilliant, crystalline, 4 to 5-partite glands. The substance of the fruit consists, in great part, of dense fibro-vascular tissue, forming a kind of 4-winged nut; the corky part consists of delicate cellular tissue; when fresh it is green and succulent. The fresh plant has a peculiar disagreeable musky odour. Simple agitation of the young branches in water, without any crushing, produces a viscid mucilage like white of egg. We find from experiment that the glandular crystalline bodies described above are the source of the mucilage; if they are gently scraped from the under-

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surface of the leaf and mixed with water, the viscidity is at once produced. The mucilage has a faint peculiar taste, but is not disagreeable.

Chemical composition.—The fruits contain a greenish-coloured fat, a small quantity of resin, and an alkaloid in the alcoholic extract. The mucilage separated by water is precipitated by acetate of lead solution and alcohol, and in these respects resembles the mucilage of gum arabic. The ash of the air-dried fruit amounts to 5·43 per cent.

Martynia diandra, *Glox. Bot. Rep.* 575, "tiger's claw" or "devil's claw," is a native of Mexico, but has become quite naturalized in India, making its appearance on waste ground during the rainy season.

The plant is herbaceous, has large cordate leaves, and handsome flowers like those of Sesame. The fruit is a green fleshy capsule which contains a hard, black, woody, wrinkled nut with two anterior hooks, having something the appearance of a beetle. The natives liken it to a scorpion, hence the names *Vinchú* and *Vichhidá*; they suppose it to have a curative effect upon the sting of that reptile, the nut being rubbed down with water and applied to the injured part. It is sold in the shops.

ACANTHACEÆ.

HYGROPHILA SPINOSA, *T. And.*

Fig.—*Wight Ic.*, *t.* 449; *Rheede, Hort. Mal. ii.*, *t.* 45.

Hab.—Throughout India. The plant and seeds.

Vernacular.—Tálmakhára, Tálmakhána (*Hind.*), Kuliakhára (*Beng.*), Kolista, Kolsunda (*Mar.*), Ekháro (*Guz.*), Kulugolike, Kolavalike (*Can.*), Nirmulli (*Tam.*), Nirugobbi (*Tel.*), Vayal-chulli (*Mal.*).

History, Uses, &c.—This plant bears the Sanskrit names of Ikshura, Kshura, Ikshugandha, and Kokiláksha, "having

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eyes like the Kokila, or Indian Cuckoo." The bluo flowers are used in the *Lákholi* ceremony, which is an offering to Mahadeva of a lakh each (100,000) of the five grains (पंचधान्य), and a lakh each of a number of different flowers. Counting these occupies the women of the house for about a month. As a medicine the Hindus consider *H. spinosa* to be cooling, diuretic, and strengthening; the root, seeds, and ashes of the plant are in general use, and are prescribed in hepatic obstruction with dropsy, rheumatism, and uriuary affections. The seeds are one of the *Panchatija*, or "five seeds," the others being those of Celastrus, Fenugreek, Ajwan, and Cumin. There are, however, several other sets of five seeds. Mahometan writers mention the use of the plant for the same purposes, and also its external application in rheumatism, but they notice more especially the use of the seeds as an aphrodisiac given either with sugar, milk or wine in doses of from one to three dirhems. Ainslie, speaking of this plant, say:—" This root, which has got its Tamool name from growing near water, is supposed to have virtues similar to those of the Moollie-vayr (*Solanum indicum*, Linn.) already mentioned. The plant is the *Bahel-schulli* of Rheede, who tells us that on the Malabar Coast a decoction of the root is considered as diuretic and given in dropsical cases and gravelish affections; the dose is about half a teacupful twice daily. The species in question is a native of the Western Coast of India, whence the root is brought across the peninsula to the medicine bazars of the Carnatic. Our article is called Katu-irki by the Cingalese." (*Mat. Ind.*, II., p. 236.) In the *Pharmacopœia of India* several European contributors bear testimony to the diuretic properties of the plant, but no mention is made of the use of the seeds as an aphrodisiac and diuretic. In Bombay they are very generally used and are to be found in every druggist's shop.

Description.—Roots often biennial, tapering, with numerous rootlets; stems herbaceous, ascending or erect, ramous, jointed, a little flattened, hairy, from 2 to 3 feet high; branches opposite, like the stem, and also nearly erect; leaves an exterior, opposite, sessile pair at each joint, within these and subalternate with the spines, several small ones in a verticel: all are linear-

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lanceolate, margins often revolute, hairy, almost bristly, size various; spines 6 in each verticel, between the leaves and flowers, awl-shaped, spreading and a little recurved; flowers verticelled, numerous, sessile, large, of a bright blue; bracts lanceolate, margins and outside bristly; calyx of two pairs of nearly equal leaflets, clothed with soft hair; corol 2-lipped, lips nearly equal; upper 2-parted, with the division emarginate, the under one 3-parted, with the division also emarginate, in the under a coloured body like a large oblong anther; filaments connected at the base, second pair larger than usual in the genus; anthers sagittate; stigma subulate, involute, with a fissure on the upper side. (*Roxb.*) The seeds are small and flattish, of irregular form and brown colour, the largest $\frac{1}{10}$ of an inch long and $\frac{1}{16}$ broad. When placed in the mouth they immediately become coated with a large quantity of extremely tenacious mucilage, which adheres to the tongue and palate and is of rather agreeable flavour.

Microscopic structure.—When a section of the seed is placed under the microscope with a drop of water the development of the mucus may be observed. It appears to spring in filaments from the columnar cells of the testa; these spread rapidly in every direction and form a network which resembles the growth of some of the lower forms of algæ; it does not dissolve when much water is added.

Chemical composition.—The roots with the lower portion of the stems were air-dried, contused, and exhausted with 80 per cent. alcohol. On concentrating the tincture, white cauliflower-like masses separated. After the whole of the alcohol had been evaporated off, the extract, which had a very strong acid reaction, was mixed with water and agitated with petroleum ether, then with ether, and finally, after having been rendered alkaline, re-agitated with ether. The petroleum ether solution on evaporation left a crystalline residue, partly in the form of white cauliflower-like nodules, and a crystalline deposit on the sides of the dish. Examined microscopically, both the nodules and the deposit were seen to consist of rod-shaped crystals. After repeated crystallization from

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alcohol, and pressing the crystals between blotting paper, by which much colouring matter and a trace of oil was separated, the residue, which was nearly white, possessed the following properties:—On being heated between watch-glasses it melted into an amber-coloured fluid, and after the lapse of some hours the glasses were filled with a white, wool-like sublimate. In water the principle was insoluble, and it was not acted upon by ammonia or dilute sodium hydrate. In concentrated sulphuric acid it dissolved with a yellow coloration, and on dilution the solution became milky. On gently heating the sulphuric acid solution and then diluting with water, a pinkish turbid fluid resulted; when chloroform was agitated with this fluid it became coloured either pink, violet, greenish or even blue, the tint appearing to depend on the degree of heat applied to the acid solution before dilution with water. The principle dissolved in chloroform, and the solution when agitated with an equal volume of concentrated sulphuric acid, failed to give the colour reaction in the chloroform layer for cholesterin, but the sulphuric acid stratum exhibited a very marked green fluorescence.

Evaporated to dryness with nitric acid a yellow residue was left, which, on the addition of ammonia, became of an orange-yellow colour, but without any trace of redness. When the solid principle was evaporated to dryness with HCl and ferric chloride, it was difficult to say what colour the residue was. The test, however, applied as described by C. Forti (*Stay. Sperim. Agri. Ital.* 18, 580), by first dissolving the principle in chloroform, adding a little strong ferric chloride and concentrated hydrochloric acid, and evaporating to dryness, left a dark-coloured residue; this, when dry and cold, was treated with chloroform and gently warmed, when a fine violet-coloured solution was afforded. The acid ethereal extract contained yellow colouring matter and possessed an aromatic odour. The alkaline ethereal extract contained a principle which afforded in a marked degree alkaloidal reactions, but we failed to obtain any special colour tests.

The seeds are glutinous, besides being mucilaginous. They contain 4·92 per cent. of nitrogen, which is equivalent to 31·14

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per cent. of albuminoids, traces of an alkaloid, and 23 per cent. of a yellow fixed oil. The mucilage is not affected by ferric chloride, plumbic acetate, or by two volumes of alcohol.

Commerce.—The seeds are kept by all druggists. Value Rs. 6 per maund of 37½ lbs. The root is an article of commerce in Southern India; elsewhere it is generally supplied by the herbalists.

Several species of **Strobilanthes** yield stems as thick as a walking-stick and quite straight, which are used, like bamboos, in the construction of mud walls and fences. The aromatic flower spikes of some of these plants are used as a rustic medicine by the natives. The bark of *S. callosus*, Nees, with an equal quantity of Undi bark (*Calophyllum inophyllum*), is used in Western India as a fomentation in tenesmus; the bark-juice, with an equal quantity of Máka-juice (*Eclipta alba*), boiled to one-half, is mixed with old Sesamum oil, a few peppercorns and ginger, heated and applied in parotitis; equal parts of the juice of the flowers and of those of *Randia dumetorum* are used as an application to bruises.

The flower spikes of this plant resemble hops in shape and size, and are covered with a viscid resinous exudation called *Mél*, having a musky and resinous odour.

BLEPHARIS EDULIS, *Pers.*

Fig.—*Burm. Fl. Ind., t.* 42; *Delile Fl. Æg., t.* 33, *f.* 3.

Hab.—Punjab, Sind, Persia. The seeds.

Vernacular.—Utanjan (*Ind. Bazars*).

History, Uses, &c.—Under the local name of Utanjan and the Persian name Anjurah, an Acanthaceous seed is sold in the Indian bazars. From an examination of the capsules which are sometimes found mixed with the seeds, there would appear to be little doubt that they are those of the plant placed at the head of this article. Utanjan is a standard native remedy and is universally kept in the druggists' shops. The author of

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the *Makhzan-el-Adwiya* (article Anjurah) gives us the following account of it, from which it would appear that the true Anjurah is the *Urtica prima* of Matthiolus (*U. pilulifera*, Linn.),* and that the seeds now in use in India have somehow come to take the place of the genuine article. He says:—"Anjurah is a Persian word; it is the Kariz of the Arabs, the Kurnah of Shiraz, the Kajít of the Turks, the Utanjan of the Indians, the Urtikparim of Latin writers, and the Harkitah of Gilan. The plant has numerous serrate leaves, which are armed with prickles, the stem is still more prickly; when it comes in contact with the body it causes redness, burning, and itching. The flowers are yellow. The seeds smooth and shining, flattened, of a brownish colour, larger than those of Sesamum, and altogether not unlike linseed. They are the officinal part, and if good should be heavy and of a brown colour." Medicinally they are considered to be attenuant, resolvent, diuretic, aphrodisiac, expectorant, and deobstruent.†

Description.—The Utanjan of the Indian shops consists of the seeds mixed with a variable proportion of broken pieces of the capsule and a few entire fruits. The latter are mitre-shaped, about $\frac{3}{10}$ of an inch long and $\frac{2}{10}$ broad, laterally compressed, sides furrowed, surface polished, of a chestnut colour; capsule 2-celled, 2-seeded; seeds heart-shaped, flat, covered with long, coarse hairs; when soaked in water the hairs disintegrate and produce a large quantity of viscid mucilage.

Microscopic structure.—Each hair is made up of several columnar cells, each of which contains a spiral fibre, which upon the solution of the cell wall uncoils and imparts an unusual stringiness to the mucilage.

Chemical composition.—The bitter principle of the seeds is a white crystalline body soluble in water, amylic and ethylic alcohol, but insoluble in ether and petroleum ether. It gives

* The Roman Nettle, *Urtica prima*, Matth. Valgr. v. 2, 469. It has brown polished seeds.

† Conf. Dios. iv., 89. περὶ ακαλύφης, also Galen; they recommend it as an expectorant.

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a reddish colour with sulphuric acid, green at the margin if impure, and is best distinguished by the fine violet colour its solutions impart when brought into contact with ferric salts. With H^2SO^4 and $K^2CR^2O^7$ an agreeable odour of salicylous acid is evolved. It is associated with a substance which reduces Fehling's solution. Another white crystalline principle is present in the seeds which is not bitter, and does not give colour reactions with sulphuric acid and ferric salts. The latter crystals melted on the surface of heated mercury at 225°. The aqueous extract of the seeds contained much mucilage and vegetable albumen. The ash amounted to 7·1 per cent.

Commerce.—Utanjan is imported into Bombay from Egypt. Value Rs. 1½ per lb. In Sind and Northern India it is collected locally.

ACANTHUS ILICIFOLIUS, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 48. Holly-leaved Acanthus (*Eng.*).

Hab.—Sea Coasts of Malabar, Ceylon, and the Sunderbunds. The plant and root.

Vernacular.—Hárkúchkánta (*Hind., Beng.*), Márándi (*Mar.*), Moranna (*Goa.*), Paina-schulli (*Mal.*).

History, Uses, &c.—Roxburgh states that the Sanskrit name of this plant is Hárikasa, but we cannot find any plant bearing this name mentioned by Hindu medical writers.

Ainslie calls the plant "Holly-leaved Acanthus," and says that Rheede mentions the use of the tender shoots and leaves ground small and soaked in water as an application to snake-bites. Bontius commends its expectorant qualities. It is a plant in great request among the Siamese and Cochin-Chinese, and is called by the latter *Cay-o-ro*, who consider the roots to be cordial and attenuant, and useful in paralysis and asthma. (*Flora, Cochin Chin.*, Vol. II., p. 375.) In the Concan a decoction of the plant with sugar-candy and cumin is given in dyspepsia with acid eructations. In Goa the leaves which

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abound in mucilage, are used as an emollient fomentation in rheumatism and neuralgia.

Description.—A common shrub in and on the edges of salt or brackish lakes, marshes, &c. Roots ramous, stems many, erect; branches few, bark smooth; prickles stipulary, four-fold, short, but very sharp. Leaves opposite, short-petioled, oblong, scolloped, waved, spinous, dentate, polished on both sides, of a firm texture, from four to six inches long, and about two broad. Spikes generally terminal, sometimes axillary, erect. Flowers solitary, opposite, large, blue, inodorous. Capsule oblong, ovate, smooth, size of an acorn, 2-celled, 2-valved. Seeds two in each cell, obliquely cordate, compressed. (*Roxburgh*).

Chemical composition.—The powdered leaves yielded to ether a quantity of fatty matter coloured strongly with chlorophyll and some soft resins. Alcohol removed more resin, an organic acid, and a bitter alkaloid. The alkaloid gave a reddish-brown colour with sulphuric acid, and was precipitated from its solutions by the usual reagents, including the volatile and fixed alkalies. Some soluble saline matter was present in the extracts of the leaves, and contributed largely to the 16·4 per cent. of total ash obtained from the air-dried leaves.

BARLERIA PRIONITIS, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 41; *Wight Ic.*, 452; *Rumph. Herb. Amb. vii.*, 13.

Hab.—Tropical India. The plant.

Vernacular.—Jhinti, Katsareya (*Hind.*), Kántajáti (*Beng.*), Vajradanti, Kalsunda, Pivala-koránta (*Mar.*), Shemmulli, Vara-mulli (*Tam.*), Múlu-govinda (*Tel.*), Kánta-shelio (*Guz.*), Goratige, Gorati (*Can.*).

History, Uses, &c.—This small shrub is the Kuranta, Kuruvaka or Kuravaka of the Hindu poets, who compare its yellow flowers to a flash of lightning. In the Gita Govinda the

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jealous Radha pictures to herself the absent Hari binding them in the floating locks of the Gopis. Other Sanskrit names are Amlana, Pitajhinta, Mahasaha, and Kuruntaka. Though not mentioned in the Nighantas, its medicinal properties appear to be very generally known; it is the *Coletta Veetla* of Rheede, and the *Hystrix frutex* of Rumphius.

The natives apply the juice of the leaves to their feet in the rainy season to harden them, and thus prevent the maceration and cracking of the sole which would otherwise occur. Ainslie says that the juice of the leaves, which is slightly bitter and acid, is a favourite medicine of the Hindus of Lower India in those catarrhal affections of children which are accompanied with fever and much phlegm; it is generally administered in a little honey or sugar and water in the quantity of two table-spoonfuls twice daily. (*Materia Indica*, II., p. 376.)

In the Concan the dried bark is given in whooping cough, and 2 tolás of the juice of the fresh bark with milk in anasarca. Dr. Bidie observes that it actsas a diaphoretic and expectorant.

A paste is made of the root which is applied to disperse boils and glandular swellings, and a medicated oil, made by boiling the leaves and stems with sweet oil until all the water has been driven off, is used as a cleansing application to wounds.

Description.—Stem short, erect; branches numerous, opposite, erect, round, smooth; the whole plant two or three feet high. Thorns axillary, generally about four, straight, slender, sharp. Leaves opposite, decussate, short-petioled, oblong, somewhat waved, mucronate, smooth. Flowers axillary, generally solitary, sessile, large, yellow. Capsule conical, 2-seeded, one seed in each cell. Root woody, perennial, with numerous lateral rigid rootlets.

Chemical composition.—With the exception of the large amount of a neutral and acid resin soluble in light petroleum ether, nothing of special interest was detected: there was no trace of any alkaloidal principle.

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Barleria noctiflora, *Linn.* Dr. Mootooswamy says that in Tanjore a decoction of this plant is a good adjunct to and substitute for human milk.

The following plant is classed by the natives along with the Barlerias, of which *B. cristata* and several other species appear to be included by the Sanskrit names Kuruntaka, Kuruvaka, and Artagala. In Hindi Jhinti is a kind of general name for these plants, and in Marathi Koránta and Áboli.

Crossandra undulæfolia, *Salisb. Bot. Mag.* 2186; *Wight Ic., t.* 461; *Rheede, Hort. Mal. ix.*, 62, is a native of the Deccan Peninsula and Ceylon, and is much cultivated about Hindu temples in other parts of India, probably on account of the colour of the flowers, which is like that of the dress of the Bhikshu or penitent. The plant bears the synonym of Priya-darsha, "pleasant to look at," and the flowers are much worn by Brahmin women in the hair. The capsules, which resemble grains of barley, are described in the *Makhzan-el-Adwiya* under the Arabic name of Asába-el-usúl as highly aphrodisiac; they afford much amusement to children from their peculiarity of suddenly bursting with a crack when moistened and projecting their seeds.

Dædalacanthus roseus, *T. And.*, a native of Western India, has tuberous, spindle-shaped roots, usually ten in number, as thick as a quill, several inches in length and covered by a dark-brown bark; leaves elliptic, glabrous, scabrous on the veins beneath; spikes axillary-peduncled, imbricated; bracts oval, somewhat wedge-shaped, acute, ciliated, with long hairs, reticulately veined; tube of corolla very long and slender; flowers deep blue, turning bright red as they fade. The root boiled in milk is a popular remedy for leucorrhœa; dose one drachm. In the Southern Concan it is given to pregnant cattle to promote the growth of the fœtus. The Marathi name is Dasamuli, "having ten roots."

Neuracanthus sphærostachyus, *Dalz. Hook. Ic. Pl., t.* 835, is a native of Western India. It is powdered and

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made into a paste which is used to cure ringworm, and the roots are administered in that form of indigestion in which fatty or saponaceous grape-like masses are observed in the stools. They resemble Serpentaria in appearance, but may be distinguished by the thick covering of white, silky hairs upon the root stock. The roots have hardly any taste. The Marathi name is Ghosvel.

ANDROGRAPHIS PANICULATA, *Nees.*

Fig.—*Bentl. and Trim.*, *t.* 197; *Wight Ic.*, *t.* 518; *Rheede, Hort. Mal. ix.*, *t.* 56.

Hab.—Throughout India, wild or cultivated. The herb.

Vernacular.—Kiryat (*Hind.*), Olen-kiraita (*Mar.*), Kálmeg (*Beng.*), Shirat-kuchchi, Nila-vembu (*Tam.*), Nela-vemu (*Tel.*), Nila-veppa (*Mal.*), Nela-bevinagida (*Can.*), Kiryáto (*Guz.*).

History, Uses, &c.—Concerning this plant, Dutt (*Hindu Mat. Med.*, p. 216) states that there is some doubt regarding its Sanskrit name. He says:—"A plant called Yavatiktá, with synonyms of Mahátikta, Sankhini, &c., is said by some to mean this herb, but the term Mahátikta, when occurring in Sanskrit prescriptions, is usually interpreted as *Melia sempervirens*, Sw.,* and Yavatiktá has not been noted by me as having occurred in any prescription, so that I am inclined to think *Andrographis paniculata* was not used in Sanskrit medicine. The plant is well known in Bengal under the name of Kálmeg, and is the principal ingredient of a domestic medicine called *Alui*, which is given to infants for the relief of griping, irregularity of the bowels, and loss of appetite." It is prepared in the following manner:—Take equal parts of cumin, *randhani* (fruit of *Carum Roxburghianum*), aniseed, cloves, capsules of greater cardamoms, and pound them thoroughly with the expressed juice of the leaves of the Kálmeg. The mass thus prepared is divided into small pills and dried in the sun. The dose is one pill rubbed down in human milk.

* *M. Azedarach*, Linn.

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Both Hindu and Mahometan medical writers would appear to have confounded this drug with chiretta.* According to Forskahl, it is common in Arabia, and is there called *Wizr.* (*Forsk. Flor. Aeg. Ar.*, CII.)

Moodin Sheriff points out that *Cara Caniram*, the name given to this plant by Rheede, signifies "Black Strychnos;" he therefore thinks it must be incorrect.

Ainslie speaks of the plant as having been brought to the southern parts of the Indian Peninsula from the Isle of France.

Flückiger and Hanbury in their *Pharmacographia* point out that it has been wrongly supposed to be a constituent of the famous bitter tincture called by the Portuguese of India *Droga amara.* In the *Pharmacopœia of India* it has been made official, and directions for making a compound infusion and compound tincture are given. Quite recently, under the name of *Halviva*, which appears to be a corruption of the Bengali word *alui* or *alvi*, a preparation of the drug has been advertised in England as a substitute for quinine. The herb is very common in shady situations as a weed of cultivation, and is much used by the natives as a domestic remedy for fever in combination with aromatics, especially with lemon-grass. The dose of the dried leaves is about ten grains combined with twenty grains of black pepper. In the Concan, Kirait, Ginger, and Dikamali are given in fever, and the fresh juice with black pepper, rock salt, and Asafœtida in colic. In the chronic febrile condition known as *Bariktáp*, Kirait, Ginger, Picrorhiza root, wild dates, and Conessi bark are infused and given with honey every morning. **A. echioides**, *Nees*, is said to have similar medicinal properties; it is the *Peetumba* of Rheede (ix., 46), who says that the juice is given in fever. **Haplanthus verticillaris**, *Nees*, and **H. tentaculatus**, *Nees*, bear the name of *Kala-kirait* in Western India, and are used medicinally. The Hindi name for these two plants is *Kastula* and the Marathi *Jhánkara.*

* The name *Kiryat* is loosely applied to many bitter drugs.

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Description.—Annual, 1 to 3 feet; stem quadrangular, pointed, smooth; leaves opposite, on short petioles, lanceolate, entire upper surface dark-green and shining, under surface paler and finely granular: they vary much in size, but the larger are usually about 3 inches in length and 1 inch in breadth; calyx deeply 5-cleft; corolla bilabiate; lips linear, reflected, upper one 3-toothed, lower one 2-toothed; flowers remote, alternate, on long petioles, downy, rose-coloured, or white streaked with purple; capsules erect, somewhat cylindrical; seeds 3 to 4 in each; root fusiform, simple, woody, with numerous fine radicles.

Chemical composition.—According to the authors of the *Pharmacographia*:—"The aqueous infusion of the herb exhibits a slight acid reaction and has an intensely bitter taste, which appears due to an indifferent, non-basic principle, for the usual reagents do not indicate the presence of an alkaloid. Tannic acid, on the other hand, produces an abundant precipitate, a compound of itself with the bitter principle. The infusion is but little altered by the salts of iron; it contains a considerable quantity of chloride of sodium."

Commerce.—*A. paniculata* is not an article of commerce, but the fresh plant is sold by the herbalists and gardeners.

JUSTICIA.

Several species of Justicia are reputed to be medicinal amongst the peasantry.

Justicia Gendarussa, *Linn., f.*, is the *Vedakodi* of Rheede (*Hort. Mal. ix., t.* 42), who says that the juice with mustard is used as an emetic in asthma, and a bath of the leaves in rheumatism. According to Louvet, it is emetic and very efficient in the colic of children. In Réunion it is called "*Guerit petit colique.*"

Description.—In gardens it is usually seen in a stunted form, as it is kept closely cut; the young shoots have a smooth

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green or purple bark; from the joints, which are somewhat tumid, spring secondary shoots. The leaves are opposite, short-petioled, lanceolar, obtuse, frequently a little scolloped, smooth; nerve and veins purple, or green, according to the variety, from 3 to 6 inches long, and ½ to 1 inch broad; spikes terminal, erect; flowers dirty white, spotted with purple. The odour of the plant when crushed is ferny, the taste peculiar, and not disagreeable.

Justicia procumbens, *Linn. Wight. Ic., t.* 1539, a native of the South Deccan and Ceylon. [*Vern.*—Ghâti-pitpâprâ (*Mar.*), Nereipoottie (*Tam.*)] is a small plant, very abundant in the rainy season. The whole herb is gathered when in flower and dried. It has a faintly bitter disagreeable taste, and is used as a substitute for Fumaria, the true Pit-pâprâ. According to Ainslie the juice of the leaves is squeezed into the eye in cases of ophthalmia (II. 246).

Description.—Stem procumbent, diffuse; leaves lanceolate-elliptic or rounded, glabrous or sparingly hairy; spikes compressed, slender; calycine segments lanceolate, membranous on the margin, minutely ciliated; bracts of the same shape and shorter than the calyx; flowers small, pale purple; root slender, long, woody, straight, with numerous slender stems spreading from the crown. The bitterness of the plant is due to an alkaloid.

Justicia picta, *Roxb. Rheede, Hort. Mal. vi., t.* 60; *Bot. Mag., t.* 1870, a well-known garden shrub, is used medicinally in the same manner as *Adhatoda Vasica.* The variegated variety is called 'White Adulsa,' and the dark-leaved kind 'Black Adulsa'; the first is, according to Rumphius (vi., 35), used pounded with the milk of the cocoanut to reduce swellings. Loureiro states that the leaves are emollient and resolvent, and notices their use as a cataplasm to inflamed breasts caused by obstruction to the flow of milk.

Justicia Ecbolium, now **Ecbolium Linneanum,** *Kurz. Wall. Pl. As. Rar. iii., t.* 108; *Bot. Mag., t.* 1847, is a small

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shrub, the roots of which have a reputation in the Concan in jaundice and menorrhagia. Rheede (*Hort. Mal. ii.*, 20) notices the use of the whole plant in gouty affections and dysuria.

Description.—Stems several, straight, jointed, and swelled above the joints; woody and round below, quadrangular and tender above; leaves elliptic-oblong, attenuated at both ends, pubescent, or glabrous; spikes terminal, tetragonal; bracts oval, quite entire, ciliated, mucronate, as long as the capsule; flowers azure-coloured; capsule half an inch long, 2-seeded.

ADHATODA VASICA, *Nees.*

Fig.—*Lam. Ill., t.* 12, *f.* 1; *Bot. Mag., t.* 861; *Griff. Ic. Pl. As., t.* 424; *Rheede Hort. Mal. ix., t.* 43. Malabar nut tree (*Eng.*)

Hab.—India, from the Punjab and Assam to Ceylon. The leaves, root, and flowers.

Vernacular.—Arúsa, Rús, Bánsa (*Hind.*), Adúlsa (*Mar.*), Bákas (*Beng.*), Adúlso, Bánsa (*Guz.*), Ádátodai (*Tam.*), Addasaram (*Tel.*), Áta-lotakam (*Mal.*), Ádúsála, Ádúsoge (*Can.*).

History, Uses, &c.—This shrub has a considerable reputation all over India as an expectorant and antispasmodic, and is largely prescribed in consumption and other chest affections attended with cough and hectic fever. Sanskrit writers call it Vasaka, Vansa, Vrisha, Sinha-mukhi "lion-mouthed" Sinhaparni "lion-leaved," and Atarúsha, Atarusha or Atarúshaka, and direct the fresh juice of the leaves to be given in doses of one tolá (180 grs.), with the addition of honey and long pepper, in cough. Dutt, in his *Hindu Materia Medica*, gives several compound preparations of the drug extracted from Sarangadhara and the Bhavaprakasa, and remarks that there is a saying that no man suffering from phthisis need despair as long as the Vasaka plant exists. In the Nighantas it is described as removing phlegm, bile, and impurities of the blood, a remedy for asthma, cough, fever, vomiting, gonorrhœa, leprosy, and phthisis. Persian writers upon Indian Materia Medica notice the plant under its Hindustani name of Arúsa. The author of

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the *Makhzan-el-Adwiya* describes it correctly, and says that the wood is used to make toothpicks and gunpowder. Medicinally the flowers are useful in hectic, heat of blood, and gonorrhœa, the root in cough, asthma, febrile disturbances, and gonorrhœa; the fruit is sometimes hung round the necks of children to keep them from catching cold. Ainslie states that "In Ceylon, the Malabar nut tree is said to grow to the height of fourteen or fifteen feet, and is there called Wanapala. The flowers, leaves, and root, but especially the first, are supposed to possess antispasmodic qualities; and are prescribed in certain cases of asthma, and to prevent the return of rigor in intermittent fever; they are bitterish and sub-aromatic, and are administered in infusion and electuary. In the last mentioned form the flowers are given to the quantity of about a teaspoonful twice daily." (*Mat. Ind.*, II., p. 3.) Roxburgh remarks that the wood is well fitted for making charcoal for gunpowder. Strong testimony in favour of the remedial properties of the drug was furnished to the authors of the *Pharmacopœia of India* by Drs. Jackson and Dutt, who employed it with marked success in chronic bronchitis, asthma, and other pulmonary and catarrhal affections. Cases illustrative of its effects in catarrh, bronchitis, and phthisis have been published by Mr. O. C. Dutt. (*Indian Annals of Med. Sci.*, 1865, Vol. X., p. 156.) In Bengal the leaves are smoked in asthma; good evidence of their value when thus used has been collected by Dr. G. Watt in the "*Dict. of the Economic Products of India.*" Dr. Watt has also brought to notice the use of Adhatoda leaves in rice cultivation in the Sutlej Valley. The fresh leaves are scattered over recently flooded fields prepared for the rice crop, and the native cultivators say that they not only act as a manure, but also as a poison to kill the aquatic weeds that otherwise would injure the rice. Experiments conducted by us show that the infusion acts upon the cells of these plants in the same manner as certain chemical reagents, by contracting their contents and causing their disintegration; it also proves poisonous to any animalcules, frogs, leeches, &c., present in the water; on the higher animals the leaves do not have this effect.

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Description.—A small tree or large shrub, flowering in the cold season; trunk straight; bark pretty smooth, ash-coloured; branches sub-erect, with bark like that of the trunk, but smoother; leaves opposite, short petioled, broad lanceolar, long, taper-pointed, smooth on both sides, about 5 to 6 inches long and 1½ broad; spikes from the exterior axils, solitary, long-peduncled, the whole end of the branchlet forming a leafy panicle, flower-bearing portion short, and covered with large bracts; flowers opposite, large, white, with small ferruginous dots, the lower part of both lips streaked with purple; bracts 3-fold, opposite, 1-flowered, exterior one of the three, large, ovate, obscurely 5-nerved interior pair much smaller, end sub-lanceolate, all are permanent; calyx 5-parted to the base, divisions nearly equal; corolla ringent, tube short, throat ample, upper lip vaulted, emarginate, lower lip broad and deeply 3-parted, both streaked with purple; filaments long, resting under the vault of the upper lip; anthers twin. (*Roxb.*)

Chemical composition.—The powdered leaves have a light green colour with a strong peculiar odour and a bitter taste. One of us has published the following report of a chemical examination: "Soaked in water and then boiled, the powder afforded 34 per cent. of a reddish-brown extract having the characteristic properties of the leaves. Incinerated at a low red heat 17 per cent. of ash was left. A remarkable alkalinity pervaded the drug, which was noticeable in the cold aqueous infusion, in the distillate obtained by boiling with water, and in the fumes given off when burning; the leaves when smoked in a pipe produced no narcotic effect; the chief result of the smoking was the evolution of much ammoniacal vapour among other products of combustion, and to the inhalation of this vapour is probably due the efficacy of the leaves in the relief of asthma. A well-defined alkaloid appears to be the most important constituent; it constitutes the bitter principle, and to all intents and purposes is the active principle. It occurs in white transparent crystals belonging to the square prismatic system, without any odour, but with a decidedly bitter taste. It is soluble in water with an alkaline reaction, and in ether, but more so in

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alcohol. It readily forms salts with sulphuric, hydrochloric, nitric, and acetic acids; these salts are crystalline, and their solutions may be evaporated without apparent decomposition. It is precipitated by potassio-mercuric iodide, iodine in potassium iodide, tannin, and Nessler's reagents. A solution of the sulphate, observed in a Laurent's polariscope, possessed a slight right-handed rotation. Heated on platinum foil it fused to a yellowish and then to a fine red mass, which afterwards blackened and decomposed. Distilled with strong potash it yielded an oily body resembling chinoline, together with ammonia and other volatile bases. I propose to call this alkaloid "*Vasicine*," after the Sanskrit name of the plant. In a proximate analysis of the leaves, petroleum ether was first used to remove the volatile oil, or stearopten, which formed one of the odorous principles. Ether was then employed to extract chlorophyll, wax, resins, and a small quantity of alkaloid. The alcoholic extract was the most interesting, as it contained most of the alkaloid in neutral combination with an organic acid. This extract was of a reddish colour when concentrated, and some soft resin was separated by treatment with water; the aqueous solution evaporated spontaneously fell into a mass of crystals exhibiting right-angled ramifications. On adding neutral acetate of lead to some of the solution, nearly all the colouring matter was removed as an orange precipitate, and an almost pure solution of the acetate of the alkaloid was left in the filtrate.

The organic acid, presumably the colouring agent of the leaves, when liberated from its lead salt by sulphuretted hydrogen, had an acid reaction, was soluble in water and spirit, and gave a dark olive-green colour with ferric chloride. The colouring matter was intensified by the addition of the fixed and volatile alkalies, and was not immediately precipitated by the mineral acids. Its lead salt after gentle ignition left 28·3 per cent. of oxide. I would suggest for this organic body the name of "*Adhatodic Acid*," after the South Indian name of the plant. The occurrence of this organic acid and the alkaloid in the aqueous solution of the alcoholic extract would indicate their natural existence in a state of combination, so that adhatodate

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of vasicine has scientific claims to be regarded as the active principle of the leaves of *A. Vasica.* The analysis of the leaves reveals certain principles resembling those found in tobacco, as, for instance, an odorous volatile principle, an alkaloid, but not volatile like nicotine, one or more organic acids, sugar, mucilage, and a large percentage of mineral salts. The leaves of Adhatoda submitted to dry distillation evolved substances similar to tobacco under the same conditions. At first water condensed, and an intolerable odour arose from a yellow oily liquid which followed. Then a brown oily substance came over, associated with the pungent vapour of ammonia; and finally a thick brown semi-crystalline solid was driven from the retort to the condensor. These products were all strongly alkaline. The following table gives the results of the proximate analysis of the leaves:—

Volatile odorous principle	0·20
Chlorophyll, fat, resins, and alkaloid extracted by ether	3·20
Adhatodate of vasicine, resin, and sugar extracted by alcohol	12·50
Gum	3·87
Colouring matter, precipitated by lead	4·83
Other organic matters and salts extracted by water	10·38
Extracted by soda solution	4·72
Residue organic	40·71
„ inorganic	9·59
Moisture and loss	10·00
	100·00

The ash was constituted as follows:—

Soluble in water	23·38
Soluble in acid	75·12
Residue	1·50
	100·00

The portion soluble in water was alkaline, and contained chlorides and sulphates. (*Pharm. Jour.*, April 7th, 1888.)

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Commerce.—The dried flowering branches are sold in the shops. Value, Rs. 3½ per maund of 37½ lbs.

RHINACANTHUS COMMUNIS, *Nees.*

Fig.—*Bot. Mag., t.* 325; *Rheede, Hort. Mal. ix., t.* 69.

Hab.—Deccan Peninsula, Ceylon. Cultivated throughout India. The leaves and root.

Vernacular.—Palak-juhi (*Hind.*), Joi-páni (*Beng.*), Gajkarni (*Mar.*), Nága-malli (*Tam.*), Nágamalle (*Tel.*), Puzhuk-kolli, Pushpa-kedal (*Mal.*), Nága-mallige (*Can.*), Gachkaran (*Guz.*).

History, Uses, &c.—Indian works on Materia Medica give various prescriptions for the use of the juice of the leaves, and the root bark of this plant as a remedy for the affection of the skin known to Europeans in India as Dhobie's itch, Malabar itch, &c. (*Tinea circinata tropica.*) Whichever part of the plant may be used, it is directed to be made into a paste with lime juice or with aromatics, and applied for several successive days to the affected place. Native testimony in favour of its efficacy is very strong. (Confer. *Makhzan-el-Adwiya*, article "*Palak-Juhi.*") Ainslie, speaking of the *Justicia nasuta*, Linn., says:—"This root fresh, when bruised and mixed with lime juice, is considered as a sovereign application for ringworms and other cutaneous affections; the leaves are also employed for the same purposes. The plant is the *Pulcolli*, also *Peelcolli*, of the *Hort. Mal.* (IX., p. 135, t. 69). I have taken the liberty of giving it the English name of Nagamullie, by which it is universally known in Lower India." (*Mat. Ind.*, II., p. 216.) Roxburgh in his *Flora Indica* (I., p. 121) states that besides its use as a remedy for ringworm, milk boiled on the roots is reckoned by the Indian physicians aphrodisiacal; the roots, he also says, are used for the bite of poisonous snakes, hence the Telinga and Tamul name Naga-mulli, or Jasmine of the Cobra-di-capello. *R. communis* is very common in gardens and grows wild upon the Western Ghauts. Roxburgh gives Yúthikaparni as the Sanskrit name, but this name is applied by

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Hindu writers to a kind of Jasmine. Latterly, under the name of *Tong-pang-chong*, Rhinacanthus has found considerable favour in Europe as a remedy for chronic eczema and some other skin affections of a similar character. An extract of the plant appears to be the best preparation.

Description.—A thin shrub, about 5 feet in height. Root woody, ramous; stems many, erect, ramous, the old woody parts round, and covered with pretty smooth, ash-coloured bark, the tender branches and young shoots jointed, smooth, and obscurely 6-sided; leaves opposite, petioled, broad-lanceolate, point obtuse, above smooth, below a little downy, entire, from 2 to 4 inches long and from 1 to 2 broad; panicles corymbiform, axillary, and terminal, always 3-cleft, as also the sub-divisions; peduncles and pedicels short, round, a little downy; bracts minute; flowers small, white; corol with a long, slender compressed tube, under lip broad, 3-cleft, upper lip erect, linear sides reflected, apex bifid; nectary, a fleshy ring surrounding the base of the germ; anthers without the tube, twin. (*Roxb.*) The leaves when chewed have a pungent taste something like cassia bark; their odour when crushed is disagreeable.

Chemical composition.—Liborius has analysed the root in the Dorpat Laboratory, finding in it 13·51 per cent. of ash and 1·87 per cent. of *Rhinacanthin*, a quinone-like body, besides the ordinary constituents of plants.

Rhinacanthin is a dull cherry-red resinous substance, which contains no nitrogen, and does not reduce copper solution. It seems to be related to chrysophanic and frangulic acids. Two ultimate analyses gave a mean of carbon 67·55 per cent., hydrogen 7·36 per cent. The formula $C^{14}H^{18}O^{4}$ corresponds with 67·20 C and 7·20 H. Its presence in the plant is said to be limited to certain intercellular spaces occurring in the bark, the cellular tissue of this part appearing to be filled with an intensely red substance, supposed to consist of a compound of rhinacanthin with an alkali. It is obtained by exhaustion of the powdered root fibres with absolute alcohol. Rhinacanthin has the peculiarity of forming with bases beautiful red compounds

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that are easily decomposed by certain neutral solvents, such as petroleum spirit, which dissolves the rhinacanthin and assumes a yellow colour. (*Pharm. Zeitch. f. Russl.*, Feb. 1881; *Year Book of Pharm.*, 1881, p. 197.)

VERBENACEÆ.

LIPPIA NODIFLORA, *Rich.*

Fig.—*Wight Ill.*, *t.* 173 *b*, *fig.* 2, and *Ic.*, *t.* 1463; *Sibth. Fl. Gr.*, *t.* 553; *Lam. Ill.*, *t.* 17.

Hab.—Throughout India and Ceylon. The herb.

Vernacular.—Bukkan (*Hind.*), Bhûi-okra (*Beng.*), Ratolia, Vakkan (*Mar.*), Ratavalio (*Guz.*), Podútalai (*Tam.*), Bokenakû (*Tel.*).

History, Uses, &c.—According to Ainslie, the Sanskrit name is Vaśira, but the Nighantas do not mention any plant bearing this name. वशिर, with the synonym of Vasuka occurs, however, in Sanskrit literature, as the name of a plant. *L. nodiflora* is considered by the Hindus to be febrifuge and diuretic, and is administered in gonorrhœa combined with cumin seed. Locally it is applied in the form of paste to promote suppuration. The author of the *Makhzan-el-Adwiya* describes it under the name of *Bukkan* as hot and dry; he states that an infusion is useful in the febrile stage of colds, and that it is diuretic and useful in lithiasis. A poultice composed of the fresh plant is a good maturant for boils.

Ainslie has the following notice of it: "The tender stalks and leaves, which are in a slight degree bitter, the native practitioners prescribe, when toasted, in infusion, in cases of children's indigestions, to the extent of two ounces twice daily; it is also sometimes ordered as a drink for women after lying-in. The plant is a native of Southern Italy and Sicily, as well as India, and has at different times had very different appellations bestowed

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on it, it being the *Blairia nodiflora* of Gærtner, the *Zapania nodiflora* of Lamarck, and the *Vervena capitata* of Forskahl. The stem is herbaceous, creeping, from 3 inches to a foot in length, sub-divided, rounded, marked with lines, and smooth. The spike is terminating, roundish, composed of small whitish or rose-coloured flowers; it has two seeds, roundish, flatter on one side than the other." (*Materia Indica,* Vol. II., p. 313.)

VERBENA OFFICINALIS, *Linn.*

Fig.—*Hayne Pl. Off.* 5, *t.* 42; *Sweet Brit. Fl. Gard. iii., t.* 202. Vervain (*Eng.*), Verveine, Herbe sacrée (*Fr.*).

Hab.—Himalaya, Bengal Plain, and Persia. The herb.

Vernacular.—Pámúkh (*Hind.*), Fáristariun or Báristariun (*Ind. Bazars*).

History, Uses, &c.—Vervain is the περιστερεών or περιστέριον of the Greeks; the word signifies "a dovecote," and the plant was so named because doves were supposed to be particularly fond of it. It was also called ἱεροβοτάνη or "holy wort," because it was used in sacrifices, purifications, and as an amulet. Dioscorides states that the leaves of the Verbena have a reputation as a local sedative and vulnerary. Pliny (25, 59) says:—"Among the Romans there is no plant that enjoys a more extended renown than *Hierabotane,* known to some persons as *Peristerion,* and among us more generally as *Verbenaca.* It is this plant that we have already mentioned (22, 3) as being borne in the hands of envoys when treating with the enemy, with this that the temple of Jupiter is cleansed, with this that houses are purified and due expiation made. There are two varieties of it: the one, that is thickly covered with leaves (*V. supina*) is thought to be the female plant; that with fewer leaves (*V. officinalis*), the male." Pliny then notices the ridiculous superstitions of the Magi in reference to the plant, and remarks that the plant bruised in wine is used as

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a remedy for the stings of serpents.. De Gubernatis states that Verbena was held in much the same estimation among the Romans as Kusa grass and the Tulasi plant among the Hindus. It bore numerous synonyms, such as Tears of Isis, Tears of Juno, Mercury's Blood, Demetria, Cerealis, &c. In the Middle Ages Verbena was held in high estimation by the Christian priesthood. Piperno (*De Magicis Affectibus*, Napoli, 1635) states, on the authority of Savonarola, that "Verbena manducata non permittit per septem dies coitum" It was considered to be a purifying herb which enforced chastity. In Sicily it is used as a charm to cure diseases at the present day along with fennel. The following is the prayer used in curing polypus with it:—

Zittu, Lucia, non lacrimari,
Scinui ni lu me ortu (come into my garden)
Scippa pampini di brivina e finocchiu
(Gather the leaves of Verbena and fennel)
Ccu li to mano la chiantasti (thou hast planted it),
Ccu li to pedi la scarpisast (thou hast trodden upon it);
La testa di lu purpu (polypus) cci scacciasti,
S'iddu è sangu sfissira (will melt away)
S'iddu è purpu à mori va.

The exorciser then makes three signs of the cross on the polypus with a clove of garlic. In some parts of Piedmont the people believe that rubbing the palm of the hand at sunset with Verbena will ensure the goodwill of the first person whose hand they grasp.

In England Vervain (ferfaen) was used by the Druids in their sacred rites, and was gathered by them with much the same ceremonies as the mistletoe. In Egypt it was sacred to Isis. In Europe it has been extolled as a remedy for most diseases, but is now generally considered to have only slight febrifuge and astringent properties. Quite recently G. Ricci (*Lo Sperimentale*, 1890, Vol. LXVI., p. 483) has again drawn attention to the plant, which he states has febrifuge properties. The root is still sometimes worn as a necklace against the king's evil by the peasantry.

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Mahometan physicians describe Verbena under the Arabic name of Rai-el-hamám (رعي الحمام) or as Fáristariun or Báristariun corruptions of the Greek περιστέριον. They state that it is tonic and astringent, useful in paralysis and amenorrhœa, and that a plaster of the leaves promotes the healing of wounds. An ointment is recommended for swellings of the womb, and a vinegar in skin diseases. In Persia it is called Gao-mashang and Div-mashang "fairies pea." According to Stewart, it is used as a tonic and febrifuge in the Punjab. In Cochin-China it is known as *Co-roi-ngua*, and is considered useful in nervous complaints and as a deobstruent in dropsy. (*Loureiro, Flor. Coch. Chin. i.*, p. 27.)

Callicarpa lanata, *Linn., Bedd. Anal. Pl.* 21, *f.* 6; *Wight Ill., t.* 173 *b, f.* 5, and *Ic., t.* 1480; *Rheede, Hort. Mal. iv., t.* 60, is a tree of the Deccan Peninsula, the Circars, and Ceylon, which, though not noticed by Sanskrit medical writers, has a popular reputation on account of its mucilaginous and emollient properties. It is also subaromatic and bitter. Rheede states that the leaves boiled in milk are used as a wash for aphthæ of the mouth, and that the bark and root boiled in water yield a decoction which is used to lessen febrile heat and remove hepatic obstruction and herpetic eruptions. Ainslie records the use of the plant as an emollient by the Javanese and as a diuretic by the Malays. Dr. G. Watt (*Dict. Econ. Prod. Ind.*) on the authority of Dr. Trimen, states that the leaves, roots, and bark are used by the natives of Ceylon in skin diseases. *C. lanata* is from 20 to 40 feet in height, the young branches are cinnamoneous, shaggy and woolly, the leaves 4 to 8 inches long, ovate lanceolate, stellately tomentose beneath; if the tomentum is removed, numerous oil glands are visible. Both leaves and bark are faintly aromatic and bitterish, and afford much mucilage when boiled. The vernacular names are Bastra (*Hind.*), Masandari (*Beng.*), Koat-komal (*Tam.*), Iswar, Meras, Tondi-karavati (*Mar.*), Tondi-teragam (*Mal.*). Rheede states that the Portuguese call the plant *Folhas da raspa Macho*, and the Dutch *Groot Rijf-blad.*

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TECTONA GRANDIS, *Linn. f.*

Fig.—*Roxb. Cor. Pl.* 1, 10, *t.* 6; *Brand For. Fl.*, 354, *t.* 44; *Bedd. Fl. Sylv.*, *t.* 250; *Rheede Hort. Mal. ix.*, *t.* 27. Teak tree (*Eng.*).

Hab.—W. Deccan Peninsula, Central India, Burmah. The wood, fruit, and tar.

Vernacular.—Sagún (*Hind.*), Segun (*Beng.*), Ság, Ságwán (*Mar.*), Tekku-maram (*Tam.*), Teku-mánu (*Tel.*), Tegu (*Can.*), Ságach (*Guz.*).

History, Uses, &c.—The teak tree is the Sáka of Sanskrit writers and the Sáj of Arabic and Persian books on Indian Materia Medica. The natives recommend a plaster of the powdered wood in bilious headaches and for the dispersion of inflammatory swellings; taken internally in doses of 90 to 200 grains it is said to be beneficial in dyspepsia with burning pain in the stomach arising from an overflow of bile, also as a vermifuge. The charred wood quenched in Poppy juice* and reduced to a smooth paste is applied to swellings of the eyelids, and is thought to strengthen the sight. The bark is used as an astringent, and the oil of the nuts, which is thick and has an agreeable odour, is used for making the hair grow and removing itchiness of the skin. (*Makhzan-el-Adwiya*, article "Sáj.") Rheede states that from the young leaves a purple dye is prepared. This colour is due to the reaction of alkalies upon a crimson body, soluble in ether, which is contained in the leaves; it forms soluble compounds with lead and baryta.

Endlicher states that the flowers are diuretic; this is confirmed by Gibson, who says that the seeds have a similar property; in two cases he saw marked diuresis follow the application of an epithem of the bruised fruit to the pubes. In the *Pharmacopœia*

* The word used in the Makhzan is *Mámitha*, an Arabic name for the Argemone of the Greeks and Romans. Two kinds of Mámitha are described by Arabic and Persian writers—one with red flowers, the other with yellow. (Conf. Dios. ii., 168, 169.) In India *Argemone mexicana* is used for Mámitha.

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of India a paste made from the powdered wood is said to allay the pain and inflammation caused by handling the Burmese black varnish which is obtained from *Melanorrhœa usitatissima.* Col. Burney (*Journ. Asiat. Soc. of Bengal,* Vol. I., p. 170) has published some interesting remarks on its use. A tar is extracted from the wood, which is used as an application to the sores of draught cattle to prevent maggots breeding. As a rule white-ants will not touch teakwood, and the use of teakwood tar has been suggested as a remedy against these destructive pests. The wood is also not easily affected when exposed to damp weather, and baskets for holding orchids are commonly made of teak in Burmah; while orchids are also preferably mounted on teak blocks.

At a meeting of the Nilgiri Natural History Society in 1887, Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambúr. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated (*vide* P. A. S. B., May 1870, p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa in their fissures, but principally Asan (*Terminalia tomentosa,* W. and A.), Swarm (*Zizyphus rugosa,* Lam.), Sissu (*Dalbergia Sissu,* Roxb.), and Abnus (*Diospyros melanoxylon,* Roxb.).

In 1880 Mr. V. Ball, in making a geological survey in the Central Provinces, met with this concretion, and thus alludes to it in his "*Jungle Life in India*": "Some white marks on the cut stumps of an Asan tree caught my eye, and these on examination proved to be sections or laminæ of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces seven inches long by two inches thick were

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met in the trunks at a height of about six feet from the ground. By the natives the lime is burnt and used for chewing with *pan*. On examination it was found there was no structure in these masses, which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood and seemed to be cemented together by the lime."

Major-General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "*Forestry of Southern India*": "It is a curious fact that in the Wynaad though there is no free lime in the soil, yet Teak (*Tectona grandis*) and Blackwood (*Dalbergia latifolia*), if wounded near the ground, contrive to absorb large quantities of lime. It may be seen encrusting the tree on the surface as far as four feet in height, from three inches to a foot in width, and two or three inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel."

Description.—Trunk erect, growing to an immense size; bark ash-coloured and scaly; branches numerous, spreading; young shoots 4-sided, sides channelled; leaves opposite, petioled, spreading, oval, a little scalloped, above scabrous, below covered with whitish rather soft down, they are larger at a distance from the flowers, and on young trees, *viz.*, from 12 to 24 inches long and from 8 to 16 broad; petioles short, thick, laterally compressed; panicles terminal, very large, cross-armed, divisions dichotomous, with a sessile fertile flower in each cleft, the whole covered with a hoary, farinaceous substance; peduncles common, quadrangular, sides deeply channelled, angles obtuse; bracts opposite, lanceolate, two at each sub-division; flowers small, white, very numerous; calyx and corolla oftener six than five cleft; nectary very small, frequently wanting, stamens often six; germ superior, round, hairy, 4-celled, with one ovule in each attached to the axis; stigma 2-cleft, divided, obtuse, spreading; drupe within the enlarged, inflated, dry calyx obtusely 4-sided, woolly, spongy dry; nut exceedingly hard, 4-celled. (*Roxb.*) The wood has a peculiar aromatie odour. The tar obtained from it is black and opaque when properly made, but

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when prepared from partly dried wood it is mixed with the sap and forms a greyish brown emulsion. The seeds are of the size and shape of Sesamum seeds; they are very oily, but the difficulty of extracting them from the nuts would make the oil very expensive; it is a bland, fatty oil, free from any peculiar odour.

Chemical composition.—Abel in 1854 showed that the wood of teak frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, $Ca\ H\ PO^4$, H^2O, with about 11·4 per cent. ammonio-magnesium phosphate. (*Chem. Soc. Qu. J. xv.*, 91.)

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate $Ca\ H\ PO^4$ (*Landw. Versuchs. St.* xxii., 68; xxiii., 413.) More recently still Professor Judd has found in teak a specimen of crystalline apatite, a well-known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case, as the ash of teakwood is composed as follows:—

CaO	MgO	FeO	K^2O	Na^2O	SiO^2	SO^3	P^2O^5	CO^2	Cl
31·35	9·74	0·80	1·47	0·04	24·98	2·22	29·69	0·01	0·01

The percentage of carbon and hydrogen are higher than in most woods, and this, together with the richness in calcium phosphate and silica, may perhaps account for the great hardness of teak." (*Watts' Dict. Chemistry, 3rd Suppl.*, p. 1894.)

Mr. D. Hooper says:—"The sample from Nilambúr was in the form of a rounded flattened cake about ten inches in diameter and two or three inches in thickness; dirty white in colour, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition

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similar to prepared chalk, with a dark-coloured gummy matter, and a small quantity of crystalline quartz sand. The following is the composition:—

Calcium carbonate	70·05
Tricalcic orthophosphate	2·89
Quartz sand	9·76
Organic matter	14·30
Moisture	3·00
	100·00

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees might show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rains to which this district is subjected would scarcely leave anything soluble on the trees.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full-sized cinchona tree contains about 10 ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to

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render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit." (*A paper read at a Meeting of the Nilgiri Natural History Society, Ootacamund, November 7th*, 1887.)

Teak wood yields on distillation with water an opalescent distillate impregnated with resinous matter, but no trace of essential oil could be obtained when operating with 126 lbs. of fresh sawdust from Indian teak. For the extraction of the tar two earthen pots were used luted together; the upper with a perforated bottom contained the wood in chips; the product was a rather liquid black tar having much the odour of coal tar. One pound of the sawdust exhausted with alcohol yielded a resinous extract, which, after having been well washed with hot water, weighed half an ounce; the resin is black, and has the peculiar odour of the wood.

The late R. Romanis (*Jn. Chem. Soc.*, 3-11-87) found that alcohol extracts a soft resin from teak wood, but no oil or varnish. On distilling the resin he obtained a crystalline substance which he also found to be present in considerable quantity in the tar resulting from the destructive distillation of teak. The analyses which he has made of the crystals point to the empirical formula $C^9 H^{10} O$; on oxidation with nitric acid they yield what appears to be a quinone of the formula $C^{18}H^{16}O^2$.

PREMNA INTEGRIFOLIA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1469; *Rumph. Herb. Amb. iii.*, *t.* 134.

Hab.—Coasts of India from Bombay to Malacca, Silhet, and Ceylon. The leaves and root.

Vernacular.—Arani, Ganiari (*Hind.*), Bhut-bhiravi (*Beng.*), Munni (*Tam.*), Ghebu-nelli, Pinna-nelli (*Tel.*), Arani (*Mar.*), Takkilé, Taggi (*Can.*), Mothi-arani (*Guz.*).

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History, Uses, &c.—This shrub, in Sanskrit Arani, Harimantha, Agni-mantha, and Vahnimantha, "producing fire by friction," is so named on account of its wood being one of those used to obtain the sacred fire. Gamble states that in Sikkim the hill tribes habitually make use of the wood of *P. latifolia* and *P. mucronata* for obtaining fire. Of the two pieces of wood used by the Hindus for this purpose, the lower or soft wood is called in Sanskrit Adharárani, and the upper or hard wood, with which friction is made, is called the Pramantha; they are considered to be symbolical of the Yoni and Upastha (organs of generation).

In the Nighantas Arani is described as hot, an expellant of phlegm and wind.

Its root is one of the ingredients of the Dasamula, and the leaves are a popular remedy in the exanthematous fevers. Ainslie states that the root has a warm bitter taste and agreeable smell, and is prescribed in decoction as a gentle cordial and stomachic in fevers. Rheede calls the plant *Appel*, and notices the use of a decoction of the leaves for flatulence. Ainslie also remarks that it is the *Folium hirci* of Rumphius and that Burman calls it *Cornutia corymbosa* and Herman *Sambucus odorata aromatica.* In Ceylon it is known as *Maha-midi* or *Midi-gass.* Atkinson states that the leaves rubbed with pepper are administered in colds and fevers, and that externally a decoction of the whole plant is used in rheumatism and neuralgia.

Description.—A large shrub or small tree, blossoming in the rainy season. Trunk short; branches numerous, often procumbent and rooting; bark smooth, dark brown, leaves opposite, petioled, cordate, serrate on the anterior margins, acute pointed, smooth on both sides, from 1 to 6 inches long and from 1 to 3 inches broad; flowers in corymbs, terminal or between two branchlets, primary divisions opposite, the last 2-forked, flowers minute, numerous, of a pale greenish-white; berries black, the size of a pea. The plant has an agreeable aromatic odour and an acidulous and astringent taste.

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Chemical composition.—The root-bark of this plant afforded a yellowish-brown powder giving an orange-brown tincture with alcohol. The tincture when evaporated left a reddish-coloured tasteless resin and some extractive matter. The resin was soluble in ether and in alkaline liquors; from the latter solution it was precipitated in greyish-brown flocks by acids. Warmed with soda, the resin evolved an odour of lemon similar to that of Kamala resin; heated with sulphuric acid a transient purple colour was developed and a fragrant odour evolved. It showed no disposition to crystallize. The watery solution of the alcoholic extract had a sweetish taste in small quantities and was nauseous in larger quantities. It contained a bitterish amorphous alkaloid, a substance reducing Fehling's solution, and an astringent body, striking a green colour with ferric chloride, but giving no precipitates with gelatine. The alkaloid gave no distinct colour reactions with the strong mineral acids.

PREMNA HERBACEA, *Roxb.*

Fig.—*Griff. Ic., t.* 447, *lower figure*; *Ferguson, Pamphl.*, Colombo, 1887.

Hab.—Sub-tropical Himalaya and South Deccan Peninsula. The root.

Vernacular.—Bhárangi (*Hind.*), Bámanháti (*Beng.*), Shirutek (*Tam.*), Gandu-bárangi (*Tel.*), Bháranga-múla (*Mar.*), Gantu-bhárangi, Náyityága (*Can.*), Kanta-bháranni (*Mal.*), Barang (*Guz.*).

History, Uses, &c.—This plant is frequently confounded with *Clerodendron serratum*, Spreng., the roots and stems of which are sold under the name of Bhárangi. In Sanskrit Bhárangi bears the names of Bhárgi, Brahmayashtika, Hangika, Bringa-ja, and Vardhaka, and is described in the Nighantas as hot, bitter, pungent, and digestive; a remover of dropsy, cough, phlegm, asthma, fever, and rheumatism. The juice of the root is given with the juice of ginger and

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warm water in asthma, and it enters into the composition of several compound decoctions for diseases of the lungs. A confection called *Bhárgi-guda* is prepared with a decoction of the root, and the ten drugs called *Dasamula*, chebulic myrobalans, treacle, and aromatics. An oil prepared with the root is recommended for external application in the marasmus of children. (*Chakradatta.*)

The properties of *P. herbacea* agree much more nearly with those attributed to Bhárangi in the Nighantas, than do those of *Clerodendron serratum*, although the latter plant is at the present time in use as Bhárangi throughout the greater part of India. Dutt attributes the drug to *C. Siphonanthus*, but the samples we obtained from Bengal consisted of the stems of *C. serratum*. Bombay was formerly supplied from the Circars with *P. herbacea*, but now uses *C. serratum*. Although the root of *P. herbacea* has been known from ancient times, it is only within the last few years that its botanical origin has been identified. It was exhibited at the Madras Exhibition of 1855, under the name of Gantu Bhárangi, among several chemical and pharmaceutical products. It is mentioned in Sir Walter Elliot's *Flora Andhrica*, published in 1859, and referred to an unknown species of Clerodendron, which, he says, might be called *acaulis*; the plant is there said to grow about Lammasingi to the west of Vizagapatam, whence it is exported to Madras and Bombay to the amount of several thousand rupees yearly.

W. Ferguson in 1861 identified the Gantu Bhārangi of Southern India with *P. herbacea*, and in a pamphlet published at Colombo in 1887 gave a figure of the plant and its root.

Description.—A small undershrub; flowering branches 1—4 inches, springing up after the jungle fires. Leaves 4 by 2—3 inches, obtuse, mature microscopically dotted above, minutely deciduously pubescent beneath, nerves 5 pair. Corymbs 1½ inch in diameter, pubescent, somewhat dense; peduncle 0—1½ inch. Calyx $\frac{1}{10}$ inch, closely pubescent; lobes ovate, obtuse. Corolla $\frac{1}{6}$ inch, greenish-white, hairy in the throat, 4-lobed, obscurely 2-lipped. Drupe ¼ inch in diameter,

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globose. Roots about as thick as a crowquill with numerous almost globular woody knots.

Chemical composition.—The constituents of this root resemble to a great extent those found in *P. integrifolia*. An orange-brown acid resin soluble in ether, alcohol and alkaline solutions, and traces of an alkaloid are the most important. There is a quantity of starch in the root, and an entire absence of astringency.

Premna tomentosa, *Willd.*, *Wight Ic.*, *t.* 1468, Naguru-chettu (*Tel.*), Pedanganeree, Kollay-cottaynellay (*Tam.*), is used medicinally in Southern India. Dr. P. S. Mootooswamy states that the leaves are diuretic, and are given internally and applied externally in dropsy. An infusion of 10 drachms of the leaves and 2 drachms of coriander in ten ounces of boiling water has been used by him with advantage in acute dropsies.

Dr. Mootooswamy has seen the natives using the leaves soaked in goat's urine or in onion juice for dropsy; sometimes chebulic myrobalans are added if the bowels are costive.

GMELINA ARBOREA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii.*, *t.* 246; *Wight Ic.*, *t.* 1470; *Bedd. Fl. Sylv.*, *t.* 253; *Rheede, Hort. Mal. i.*, *t.* 41.

Hab.—Deccan Peninsula, and Ceylon to N.-W. Himalaya. The root and fruit.

Vernacular.—Kambhári, Gumhár, Shevan (*Hind.*), Gámári (*Beng.*), Shivani, Shevana (*Mar.*), Shivannigida (*Can.*), Gumadi (*Tam.*), Gumar-tek, Peddagomru (*Tel.*), Kumbulu (*Mal.*), Shewan (*Guz.*).

History, Uses, &c.—In the Nighantas this tree bears the Sanskrit names of Ghambhári, Sriparni, Kásmari, &c. The root is described as bitter, tonic, stomachic, laxative, and useful in fever, indigestion, anasarca, &c. It is an ingredient of the Dasamula, or "ten roots," and is therefore much used in a variety of diseases. Bangasena says that Gambhári root taken with

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liquorice, honey, and sugar increases the secretion of milk. The fruit is bitter-sweet and cooling, and enters into the composition of several cooling decoctions which are recommended for fever.

The following is an example: Take of the fruits of *G. arborea* and *Grewia asiatica* (parushaka), liquorice root, red sandal wood, and the root of *Andropogon muricatus* (ushira), equal parts, in all two tolás (360 grains), water thirty-two tolás, and boil till reduced to one half. (*Chakradatta*, quoted by Dutt, *Hind. Mat. Med.*, p. 218). The juice of the young leaves is used as a demulcent in gonorrhœa, cough, &c., alone or with other demulcents (*Pharmacopœia of India*, p. 164). The bark of the tree is used by arrack manufacturers in the Madura district to regulate the fermentation of toddy.

The wood of this tree on account of its lightness and toughness is much valued for carriage-building and all ornamental work; it is light yellow with a reddish heart wood, close and even-grained, easily worked, and readily takes paint or varnish. At the Government Medical Store Depôt Workshops it has been found to be the best wood for making artificial limbs, stethescopes, &c. It turns well. Weight 30 to 40 lbs. per cubic foot.

Description.—An unarmed tree, sometimes attaining 60 feet, deciduous, flowering with the young leaves. Leaves 9 by 6 inches, more or less acuminate, entire, mature glabrate above, stellately hairy beneath; petiole 3 inches, top glandular. Panicles often one foot in length, terminal; bracts $\frac{1}{3}$ inch; flowers numerous. Calyx $\frac{1}{6}$ inch, teeth very small or obsolete. Corolla brownish-yellow, upper lip shortly bifid, longer than the lower. Drupe $\frac{3}{4}$ inch, ovoid, usually 2 to 1 seeded. The roots have a light brown bark and yellowish wood, which is light and tough; they have a bitterish mucilaginous taste. The fruit is bitter-sweet and mucilaginous.

Chemical composition.—The root reduced to fine powder lost 8·39 per cent. at 100°C. The ash amounted to 14·41 per cent., and was free from any trace of manganese.

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On analysis the following results were obtained :—

Petroleum ether extract	......	1·80 per cent.
Ether ,,	......	·21 ,, ,,
Alcoholic ,,	......	4·274 ,, ,,
Aqueous ,,	...	19·560 ,, ,,

The petroleum ether extract consisted of a yellow viscid oil, with slight siccative properties. On standing, white grains separated, which were non-crystalline when examined microscopically. In alcohol the extract was partly soluble: no alkaloid was present. The ether extract was yellowish-white, and contained a trace of oil; it gave no reaction with ferric salts: in addition to resins a trace of benzoic acid was present.

The alcoholic extract was yellow and brittle: with water a turbid mixture was obtained, which had a bitter taste. In addition to resins a trace of an alkaloidal principle was detected.

The aqueous extract was sweetish and slightly bitter, and easily reduced Fehling's solution on boiling.

The fruit contained butyric acid, with a trace of tartaric acid, a trace of astringent matter giving a greenish coloration with ferric chloride, an alkaloid, and a white principle, non-crystalline, and neutral, with resin and saccharine matter.

The alkaloids present in the fruit and in the root appear to be identical. The amount present in each case was very small, not exceeding a trace.

Several species of Gmelina are sometimes used as demulcents.

G. asiatica affords the *Radix Deiparæ* or *Rais madre de Deos* of the Portuguese. Rumphius (*Hort. Amb.*, i., p. 129) relates that formerly its roots were dug only on St. Mary's day, and that only those roots which turned towards the north were selected for use. It was in great request in Goa as an antidote to every poison, and a remedy for every disease in former days. The roots are slightly bitter, astringent, and aromatic. Loureiro says:—" Valent in doloribus articulorum, et affectibus nervorum, radix interne sumpta; folia externe applicata." (*Flor. Cochin-Chin.*, ii., p. 376.) The Tamil name

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is *Nilacímal*, and the Telugu *Nela-gúmádi*. (*Ainslie, Mat. Ind.*, ii., p. 240.)

VITEX NEGUNDO, *Linn.*

Fig.—*Wight Ic.*, *t.* 519; *Rheede, Hort. Mal. ii.*, *t.* 12.

VITEX TRIFOLIA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 2187; *Rheede, Hort. Mal. ii.*, *t.* 11.

Hab.—Throughout India and Ceylon. The leaves, root, and fruit.

Vernacular.—Sambhálu, Nisinda (*Hind.*), Nisinda (*Beng.*), Vanai, Nigudi, Lingur (*Mar.*), Vellai-nochi, Nir-nochi (*Tam.*), Tella-vávili, Niru-vávili (*Tel.*), Nochi, Nirnochi (*Mal.*), Lakki, Karé-lakki (*Can.*), Niguri (*Guz.*).

History, Uses, &c.—These two shrubs, the properties of which appear to be identical, are described by Sanskrit writers under the names of Nirgundi, Sindhuvára,* Sephálika, Sveta-pushpi, Pushpanílika, &c. Two varieties are recognised: one with pale blue flowers (*Svetapushpi*), and the other with blue flowers (*Pushpaníliká*). Among the Tamils, one of these plants is supposed to be male and the other female, and for this reason they are usually combined together in their prescriptions. In the Nighantas, Nirgundi is described as cephalic, pungent, astringent, bitter and light; a remedy for colic, swellings, rheumatism, worms, leprosy, dyspepsia, phlegm, and boils.

The leaves are generally used as a discutient fomentation in sprains, rheumatism, swelled testicles, contusions, &c. The root is thought to be tonic, febrifuge, and expectorant, and the fruit nervine, cephalic, and emmenagogue.

Mahometan physicians use these plants as substitutes for *Vitex Agnus-castus*, the fruit of which is imported into India and sold in the bazars as Sambhálu-ke-bij.

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* Sinduka, Sinduvára or Syandavára, from being used to prevent a flow of humours, is probably more correct.

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V. Negundo is the Lagondium of Rumphius, who states that the leaves are used to preserve rice and clothes from insects and to drive them away; and that the Javanese women make an extract from it which they use as a carminative and emmenagogue. In India the leaves are often placed between the leaves of books to preserve them from insects.

V. trifolia, Linn., is highly extolled by Bontius. (*Diseases of India*, p. 226.) He speaks of it as anodyne, diuretic, and emmenagogue, and testifies to the value of fomentations and baths prepared with 'this noble herb,' as he terms it, in the treatment of Beri-beri, and in the allied and obscure affection, burning of the feet in natives. Of *V. Negundo*, Fleming remarks (*Asiat. Researches*, Vol. XI.) that its leaves have a better claim to the title of discutient than any other vegetable remedy with which he is acquainted. The mode of application followed by the natives is to put the fresh leaves into an earthen pot and heat them over the fire till they are as hot as can be borne without pain; they are then applied to the affected part, and kept *in situ* by a bandage; the application is repeated three or four times a day until the swelling subsides. Pillows of the dried leaves are sometimes used to lie upon for cold in the head and headache. Dr. Hové (1787) states that the Europeans in Bombay call it the fomentation shrub, and that it is used in the hospitals there as a foment in contractions of the limbs occasioned by the land winds. In the Concan the juice of the leaves with that of Máká (*Eclipta alba*) and Tulasi (*Ocimum sanctum*) is extracted, and Ajwán seeds are bruised and steeped in it, and given in doses of six *massas* for rheumatism. The juice in half tolá doses with ghi and black pepper is also given, and in splenic enlargement 2 tolás of the juice with 2 tolás of cow's urine is given every morning. A very interesting account of the treatment of febrile, catarrhal, and rheumatic affections, as practised by the people of Mysore, by means of a sort of rude vapour bath prepared with this plant, is furnished by Dr. W. Ingledew. (*Edin. Med. and Surg. Journ.*, Oct. 1817, p. 530.) Roxburgh mentions the use of baths prepared with the aromatic leaves in

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the puerperal state of women in India. According to Ainslie, the Mahometans are in the habit of smoking the dried leaves in cases of headache and catarrh. The dried fruit is deemed vermifuge. (*Phar. of India*, p. 163.)

Description.—A shrub growing in patches; branchlets, panicle, and underside of the leaves white, with a fine tomentum; leaves petioled, 3 to 5 foliolate; leaflets lanceolate, long, acuminated, entire, or coarsely cut and crenated; panicle terminal, pyramidal; flowers bluish-white to blue; berry black, the size of a pea. The habit of the shrub is variable; when growing near the sea it has almost always 3-foliolate entire leaves, the leaflets being attenuated into the petioles; inland, the shrub has a more delicate appearance; the petioles of the leaves are much longer and the leaflets, from 3 to 5 in number, are often serrated. The serrated variety is preferred for medicinal purposes, and is called *Kátrí*. The leaves of both varieties appear to be equally aromatic; the odour reminds one of the English Bog Myrtle (*Myrica Gale*, Linn.); the taste is bitter and nauseous. The berry is very feebly aromatic. In Anthony Collin's French Translation of Clusius, Lyons, 1602, there are figures of both plants, which, though old and quaint, represent the general appearance very fairly.

Chemical composition.—The leaves contain principally an essential oil and a resin. The oil possesses the odour of the drug and is neutral and almost colourless. The resin dissolves in alkaline solutions with a reddish-brown colour, softens below 40° C., and gives off aromatic vapours when heated. A tincture of the drug gives a green colour withferric chloride. The ash of the air-dried leaves amounts to 7·75 per cent.

The fruits contain an acid resin, an astringent organic acid giving a green colour with ferric salts and a precipitate with gelatine, malic acid, traces of an alkaloid and colouring matter. The fruits previously dried at 100° gave 6·8 per cent. of ash.

Vitex Agnus-castus, *Linn.* Mahometan physicians, under the Arabic name of Athlak and the Persian Panjangusht,

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describe the ἄγνος of the Greeks and the Vitex of the Romans. The berries under the names of Hab-el-fakad and Sambhálu-ke-bij are imported into India and are considered to be astringent, resolvent, and deobstruent, and useful for removing obstructions of the brain and liver; they are also given for enlargement of the spleen and dropsy. *V. Agnus-castus* is also called by the Arabs Zu-khamsata aurák, "the five-leaved," and in Egypt is known as Kaf Miryam, "the hand of Mary." Among the ancients it was sacred to Esculapius, and was considered symbolical of chastity. In the Middle Ages the fruit was known as "Monks' pepper." The fruit is sold in Bombay as *Rénuka,* the true rénuka (*Piper aurantiacum*) is not known in Western India.

Description.—A small, dull gray, ovoid fruit, the size of a duckshot, half enclosed in the calyx, to which a portion of the peduncle remains attached. Upon section it is found to be extremely hard, and, if perfect, to consist of four cells, each containing a small flat seed. Generally one or more of the cells are abortive.

Chemical composition.—The seed of *V. Agnus-castus* has been found to contain a peculiar bitter principle called *Castine,* a volatile acrid substance, a large quantity of free acid and fat oil. In Greece the fresh and rather unripe berries are said to be added to the must of the grape to render the wine more intoxicating, and prevent it from turning sour. (*Landerer, Buchn., Repert. liv.,* 20; LXXXI., 229; *Buchn. N. Repert.,* III., 392.)

CLERODENDRON INERME, *Gärtn.*

Fig.—*Gärtn. Fruct. I., t.* 57, *f.* 1; *Rheede, Hort. Mal. v., t.* 49.

Hab.—India and Ceylon, near the sea. The leaves.

Vernacular.—Sangkupi, Chhoti-arni (*Hind.*), Isamdhári (*Dukh.*), Shen-gankuppi (*Tam.*), Pishinika, Utichettu (*Tel.*), Banjoi (*Beng.*), Koivel, Vanajai, Lahán-khári-narvel (*Mar.*), Naitakkilé (*Can.*).

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History, Uses, &c.—This is a shrub the medicinal properties of which are widely known in the East. Some identify it with the Kshudrágnimantha of the Rája Nirghanta. It is the *Gambir-laut* of Java, the *Wœl-bu-rœnda* of Ceylon, and the *Sanfu-mun* of Cochin-China. Ainslie says the juice of the leaves and root is considered alterative in scrofulous and venereal affections, the dose being a tablespoonful with or without a little castor oil. Rheede speaks of the use of the dried leaves for the same purpose, and of a poultice of the leaves to resolve buboes; he also says a bath prepared with them is used in mania, while the root boiled in oil affords a liniment useful in rheumatism. *C. inerme* is the *Jasminum litoreum* and *Pharmacum litoreum* of Rumphius (*Lib.* vii., cap. 47), who says the Amboyna name is *Wale-puti-lohaha,* which means "white strand cord." The Malays and Macassars administer the berries or the root to people poisoned by eating unwholesome fish; the leaves smeared with oil are heated over the fire and applied to recent wounds; they are also one of the leaves used for preparing the green rice of the Malays; he concludes by saying "larga ac fausta natura in cunctis fere litoribus hanc obviam profert plantam." In Bombay the plant has a great reputation as a febrifuge; the juice of the leaves is used in doses of half an ounce. It is mucilaginous, very bitter, somewhat saline, and with a fragrant, apple-like odour.

The medicinal properties of *C. inerme* closely resemble those of Chiretta. The dried leaves have been found to be quite as efficient as the juice of the fresh plant; they should be dried in the shade to preserve their aroma, and may be administered in decoction with aromatics, or powdered and made into pills. A tincture has also been found to be an efficient preparation.

Description.—A straggling shrub, 3—7 ft.; shoots grey-pubescent. Leaves opposite, rarely ternate, $\frac{3}{4}$—$1\frac{1}{2}$ in., when young somewhat grey-pubescent, base cuneate; petiole $\frac{1}{8}$ in. Peduncles $\frac{1}{2}$—$1\frac{1}{2}$ in., all axillary, 3—7 fid.; bracts $\frac{1}{30}$ in., linear; pedicels $\frac{1}{8}$—$\frac{1}{6}$ in., calyx grey-puberulous or glabrate. Corolla white, tube $\frac{3}{4}$ in., glabrate, lobes $\frac{1}{3}$ in., oblong. Drupe $\frac{1}{2}$ by $\frac{1}{3}$ in.,

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spongy, hardly succulent, smooth, hardly sulcate, separating into four woody pyrenes. Or the leaves may be mostly ternate or sublinear and larger. The drupe also may vary in size. Some on this account make Rumphius' plant a separate species under the name of *C. neriifolium*, but Bentham and Kurz consider it only a variety.

Chemical composition.— A proximate analysis of the leaves gave the following results:—

Ethereal extract	4·77
Alcoholic ,,	5·70
Aqueous ,,	15·54
Alkaline ,,	11·48
Organic residue	50·06
Inorganic ,,	6·44
Moisture ,,	6·01
Total	100·00

Ash soluble in water	44·14
,, ,, in acid	47·10
Sand and silicates	8·76
Total	100·00

Sodium chloride in ash	24·01

The bitter principle is entirely removed by ether, and the subsequent treatment by alcohol and water affords extracts which are free from any bitterness. Ether, alcohol, and water independently exhaust the leaves of this principle, but the former removes it with less admixture of foreign substances. The ether extract evaporated and mixed with water will give up the bitter property to the solvent, and this by gradual evaporation leaves it in an almost pure condition. It is obtained as a viscid mass, which, in process of time and by exposure to the air, hardens, and may be reduced to a non-hygroscopic powder. It is soluble in water, with a slightly acid reaction, and is partially rendered insoluble by neutral plumbic acetate, thus giving evidence of its compound nature. The portion precipitated by the lead salt, when liberated from the metal by hydrogen sulphide, was a

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light-coloured amorphous acid powder, soluble in water, spirits of wine and ether, and reducing Fehling when in aqueous solution. The bitter principle that escaped precipitation by plumbic acetate was readily shaken out of the acid filtrate with ether. This was a whitish amorphous powder soluble in water, with a neutral reaction, and did not reduce Fehling's solution; it was not precipitated by alkalies, and was not coloured with ferric chloride; it was chiefly distinguished by its being precipitated by tannin and affording a transient red-brown colour with strong sulphuric acid. The dual nature of the bitter principle seems to show a very remarkable resemblance with that found in Chiretta (*Swertia Chirata*), a gentianaceous plant. Chiretta has been investigated by Höhn, who found the drug to contain *Ophelic acid* $C^{13} H^{20} O^{10}$ and *Chiratin* $C^{26} H^{48} O^{15}$, an acid and neutral bitter principle respectively, and representing the activity of the herb.

The leaves, when distilled with water, yield a stearopten-like body having the fruity flavour of the fresh plant. The ether extract was fragrant, green, and of a greasy consistence. The alcoholic extract contained some resinous matter, and much of the salt, which was left as cubical crystals when evaporated. Water dissolved out gum and brown colouring matter. Neither tannin nor starch was present in the leaves. They left on gentle incineration as much as 15·29 per cent. of ash, and the large amount of salt in this ash indicates the habitat of the plant as being in close proximity to the sea. (*Hooper in Pharm. Record*, Aug. 1st, 1888.)

CLERODENDRON INFORTUNATUM, *Gärtn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 25; *Burm. Zey., t.* 29.

Hab.—Throughout India. The leaves.

Vernacular.—Bhânt (*Hind.*), Bhat (*Beng.*), Chitu (*Nepal*), Bhándir, Kari (*Mar.*), Karé (*Can.*).

History, Uses, &c.—Rheede states that the leaves of this plant are used as a vermifuge, and that the root rubbed down with

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buttermilk is administered in colic and lientery. Dr. Bholanath Bose has drawn attention to the leaves as a cheap and efficient substitute for Chiretta. (*Pharmacopœia of India.*) Brigade-Surgeon J. H. Thornton considers the expressed juice of the leaves to be an excellent laxative, cholagogue, and anthelmintic; also a valuable bitter tonic, and useful as an injection into the rectum for the destruction of ascarides. These opinions are supported by those of six other medical officers quoted by Dr. G. Watt in the *Dictionary of the Economic Products of India*, ii., p. 373. M. C. Dutt gives Bhándira as the Sanskrit name, but this name does not occur in the Rája Nirghanta, and is usually applied to other plants. In Western India it has been identified with the Kári of the Rája Nirghanta.

Description.—A gregarious shrub spreading by underground suckers, 3 to 6 feet in height. The leaves are from 8 to 10 inches long, and from 7 to 8 inches broad at the base, ovate-cordate, hairy on both sides, odour disagreeable, taste bitter, and slightly astringent. The inflorescence forms large, terminal, cross-armed panicles, flowers white, streaked with pink, sweet-scented; after they have fallen, the calyxes enlarge and turn red.

Chemical composition.—A proximate analysis of the leaves gave the following result:—

Ethereal extract	10·81
Alcoholic ,,	16·40
Aqueous ,,	15·20
Alkaline ,,	8·97
Organic residue	38·47
Inorganic ,,	5·93
Moisture	4·22
Total	100·00

Ash soluble in water	16·83
,, ,, in acid	72·86
Sand and silicates	10·30
Total	100·00

Sodium chloride in ash	5·58

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The leaves of *C. infortunatum* were devoid of the odorous principle noticed in the former species, and yielded no volatile constituent when boiled with water. The ether extract contained a quantity of resinous matter, and gave up the bitter principles when heated with water; the extract was of a less fatty consistence than that from the *C. inerme* leaves. The spirituous extract was also much larger than in the previous sample, and was differently constituted, inasmuch as it almost entirely consisted of a tannin, giving a green colour with ferric chloride. These leaves contain much more soluble organic matter than the former, but the percentage composition of the ash shows that the soluble inorganic salts are much smaller. The ash of these leaves amounted to 12·3 per cent. (*Hooper in Pharm. Record,* Aug. 1st, 1888.)

Clerodendron Siphonanthus, *Br., Lam. Ill., t.* 79, *f.* i.; *Wight Ill., t.* 173, is stated by M. C. Dutt to be in use in Bengal as Bhárangi, but the samples of that drug which we obtained from Calcutta and Cawnpore proved to be the stems and roots of **C. serratum,** *Spr., Wight Ic., t.* 1472; *Bot. Mag., t.* 2536. From enquiries we have made there is no doubt that the latter plant is largely used in many parts of India as a substitute for *Premna herbacea,* the true Gantu Bhárangi, but if we regard the root of *C. serratum* as the true Bhárangi, and the root of *P. herbacea* as the Gantu (or knotted) Bhárangi, there will be no confusion. *C. serratum* has a light-coloured root, very often contorted, and seldom more than an inch in diameter. A light brown epidermis and thin bark cover the tough woody portion, which shows well-marked medullary rays and concentric rings. The drug contains much starch, it is faintly bitter, and has no peculiar odour. The young tops and light blue flowers are used as a vegetable by the natives.

The root of *C. serratum* did not yield anything of great activity when examined chemically, which proves that there is little to recommend it as a medical agent. The wood of the root is almost inert and tasteless; the thin bark constitutes only one-fifth of the weight of the dried root and contains a small

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quantity of the peculiar bitter principles, dissolved by ether, associated with an acrid resinous substance, and some fatty material. It is interesting to observe, however, that the reactions of the bitter principle, although occurring in such small quantity, were identical with that obtained in the leaves of the other two species, where it formed from ½ to 1 per cent. of the total.

AVICENNIA OFFICINALIS, *Linn.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 271; *Wight Ic., t.* 1481; *Rheede, Hort. Mal. iv., t.* 45. The White Mangrove (*Eng.*), Palétuvier blanc (*Fr.*).

Hab.—Mangrove swamps of Deccan Peninsula and Ceylon. The seeds and bark.

Vernacular.—Bani (*Beng.*), Mada-chettu, Nalla-mada (*Tel.*) Upputi (*Mal.*), Tivara (*Mar.*), Timmar (*Sind*).

History, Uses, &c.—This plant derives its generic name from the celebrated Arabian physician Avicenna (Ibn Sina). The green fruit mixed with butter and boiled is made into a plaster, which is used for softening and maturing tumours, and to promote the healing of the ulceration caused by small-pox. This property of the fruit is alluded to by Camoens in the "Lusaid"—

> "Wide forests there beneath Maldivia's tide
> From withering air their wondrous fruitage hide.
> The green-hair'd Nereids tend the bowery dells,
> Whose wondrous fruitage poison's rage expels."

The bark is astringent and is used by tanners. In Madras the ashes of the wood are used by washermen for washing clothes. The wood is valued on account of its durability under water, and as a fuel for heating furnaces it is preferred to other kinds of wood on the West Coast of India. The seeds are bitter, but are sometimes eaten.

Description.—A shrub or tree with opposite evergreen leaves, which are oblong, entire, and covered beneath with a white pubescence. The flowers are arranged in closely-packed

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terminal bunches, and are of a dirty yellow colour. The fruit is a broad, compressed capsule, one inch in length, dehiscing by two thick valves; seed erect, cotyledons large, plaited lengthwise, radicle inferior, villous. The roots stand out of the mud in which they grow, overarching each other in erect angled masses, and send up asparagus-like shoots from their underground parts.

Chemical composition.—The bark of *A. officinalis* is used in Madras as a dyeing agent rather than as a tan. It contains a red colouring matter striking a greenish colour with ferric chloride, but giving no precipitate with gelatine. The colouring matter is precipitated by acids and redissolved by alkalies. The ash of the air-dried bark amounts to 11·4 per cent., and is deliquescent.

LABIATÆ.

OCIMUM BASILICUM, *Linn.*

Fig.—*Wight Ic.*, *t.* 868; *Jacq. Hort. Vind.* iii., *t.* 72; *Rheede, Hort. Mal.* x., *t.* 87. Sweet Basil (*Eng.*), Grand Basilié (*Fr.*).

Hab.—Persia, Punjab. Cultivated throughout India. The herb and seeds.

Vernacular.—Názbo, Sabza (*Hind.*), Sabja (*Mar.*, *Guz.*), Násbo, Sabja, Baboi-tulsi (*Beng.*), Tirunitru-pachchai (*Tam.*), Vibudi-pattri (*Tel.*), Kam-kasturi (*Can.*).

History, Uses, &c.—The Hindus dislike the smell of this plant; the Mahometans on the other hand are very partial to it. The Arabs call it Rihán or "the herb," and the Persians Shahasperham or "king of herbs," and Názbu, "having a delicate odour"; it is also known in Persia as Habak-i-Kirmáni, "Kirman mint," from its abundance in that province. The author of the *Makhzan* states that it is the اصيم (Ocimum) of

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Europeans, who call the large-leaved variety *Ocimum magnum*, and the small-leaved *Ocimum parvum*. The plant is considered to be hot and dry, deobstruent, carminative, and stimulant, and the seeds taken whole are much valued on account of their mucilaginous properties: when crushed they are said to be astringent, and are prescribed in fluxes from the bowels. The juice of the plant snuffed up causes sneezing and clears the brain. *O. basilicum* is probably the ὤκιμον of Dioscorides, but perhaps not of Theophrastus, who describes ὤκιμον as a shrub. The Ocimum of Pliny is probably a kind of clover which also bore this name, as he states that it is given to mares and asses to promote conception.

De Gubernatis (*Myth. des Plant*, ii., 35) gives an interesting account of the history of Basil in Europe where it is considered to be erotic and funereal. In Southern Italy it is worn in the waist or bosom of young girls and in the hair of married women, and is called *Bacia-nicola;* the youths stick a sprig of it above the ear when they go courting. In Tuscany the Basil is called *Amorino*. In Crete it is a sign of mourning, but is universally cultivated in window gardens; Boccacio's story of Isabetta of Messina is too well known to require repetition. De Gubernatis is of opinion that all the superstitions concerning this plant current in Southern Europe are of Byzantine origin. According to the *Apomasaris Apotelesmata*, to dream of Basil is unlucky.

In Europe Sweet Basil is used as a potherb for seasoning certain kinds of food, and is considered to have the same general qualities as thyme, sage, &c. It has long been a popular remedy for mild nervous or hysterical disorders, and in Buenos Ayres its fresh juice is said to be used as an anthelmintic, and to possess the advantage of not tending to produce unpleasant symptoms. Its essential oil was formerly in vogue as a carminative and nervine. (*Med. Record*, xvi., 325.)

Description.—Three forms of this plant are common in India: the mint-like garden basil, with large flowers and green or purple stems; the variety *pilosum* of Roxburgh having a

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pleasant lemon odour; and a small variety common in gardens and on waste ground having a marked peppermint odour, and hardly different from *O. canum.* The ordinary garden basil has brown nutlets, but those of the pilose variety are black and correspond with the drug imported from Persia under the name of Tukm-i-riháu. They are small, black, oblong nutlets, barely $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, at the base there is a small projection with a white point. They have no odour, the taste is oily and slightly pungent. When moistened they become coated with a semi-opaque mucilage.

Chemical composition.—The leaves distilled with water yield about 1·56 per cent. of a yellowish-green oil, lighter than water (*Raybaud, J., Pharm.* 20, 447), which, when kept, solidifies, almost wholly, as crystallised *basil-camphor;* the solid oil crystallised from alcohol forms 4-sided prisms, having a faint smell and taste; crystallised from water, it forms white, transparent, nearly tasteless tetrahedrons. It is neutral. Formula $C^{20} H^{16}$ 6 HO. (*Bonastre, Dumas and Peligot in Gmelin's Handbook*, 14, 359.)

The price of the Persian seeds in Bombay is Rs. 4 per maund of 37½ lbs.

OCIMUM GRATISSIMUM, *Linn.*

Fig.—*Jacq. Ic. Pl. Rar. iii., t.* 495; *Rheede, Hort. Mal. x., t.* 86.

Hab.—Bengal, Chittagong, E. Nepal, Deccan Peninsula. The leaves.

Vernacular.—Ram-tulasi (*Hind. Mar. Beng.*), Elumicham-tolashi (*Tam.*), Nimma-tulasi (*Tel.*), Káttu-tuttuva (*Mal.*), Káda-tulasi (*Can.*).

History, Uses, &c.—This plant is the Varvara, Barbara, and Ájvalla of the Nighantás. The leaves have a remarkably grateful lemon odour and taste, and are made into a *chutney*

by the Hindus, and are also used as a cooling remedy in gonorrhœa. Baths and fumigations prepared with this plant are used in the treatment of rheumatism and paralysis. A decoction of the mucilaginous seeds is used as a demulcent. This plant has been wrongly identified with the Palangmishk or Faranjmishk of Persia. The seeds imported into Bombay from Persia under these names bear no resemblance to those of *O. gratissimum.*

Description.—Stem erect, woody, perennial; bark ash-coloured; branches opposite, erect, 4-sided, when young smooth, glossy and green, whole height of the plant from 4 to 8 feet; leaves opposite, long-petioled, drooping, oblong, ventricose, remotely serrate, pointed, smooth on both sides, often 6 inches long, including the petiole, which is about a third of the whole; racemes terminal, pretty long, rigidly erect, with the verticels of six flowers pretty close; bracts short petioled, reflexed, cordate lanceolate; calyx, upper lip marked with three nerves; corol short, scarcely larger than the calyx, of a pale yellow underneath, oblong, concave, and entire; filaments longer than the corol, with a large tuft of dark yellow hairs on the joints of the large pair near the base. (*Roxb.*)

OCIMUM SANCTUM, *Linn.*

Fig.—*Burm. Thes. Zeyl.* 174, *t.* 80, *ff.* 1, 2; *Rumph, Herb Amb. v., t.* 92, *f.* 2. Holy Basil (*Eng.*).

Hab.—Throughout India. The leaves.

Vernacular.—Tulsi (*Hind., Guz.*), Tulasi (*Tam., Tel., Mal., Beng., Mar., Can.*).

History, Uses, &c.—The Tulasi plant is venerated in India by the Hindus like the Vervein was amongst the Romans. Its worship is expounded in the *Tulasikavaçam*, a little book composed of two parts: the first being the Tulasikavaçam

proper or "Tulasi amulet," from the *Tulasimáhátmya* of the *Brahmanda Purana,* and the second, a hymn in honour of the plant by a certain Pundarîka. The Tulasi is invoked for the protection of all parts of the body in life and death, and especially in its quality of *putradah putrakánkshinám,* or "giver of children." The plant is the beloved of the gods and of pious persons, to whom it affords its *amrita* (ambrosia); it is especially dear to Vishnu and Lakshmi, whence its synonyms Haripriya, Vishnupriya and Lakshmipriya. The divine Nárada has sung the praises of this immortal plant, which contains in itself every perfection, cures every ill, and purifies and guides to the heavenly paradise those who worship it. The mystery of the Tulasi is the mystery of the Creator.

The worship of the plant is strongly recommended to Vishnuites in the latter part of the *Padmapurana,* and it is also worshipped by the followers of Siva. Krishna, the popular incarnation of Vishnu, has adopted this herb for his cult, whence the name Krishna-tulasi. Sita, according to the *Ramayana,* was turned into a Basil plant, which on this account bears the synonym Sitahvaya. The connection between the Tulasi and the Amrita is indicated by the suspension over the plant of a dropping pot of water in the month *Vaisakh.* Worshippers of Vishnu wear a necklace of Tulasi beads, and the Vishnu *dûtas* or "messengers of Vishnu," carry *tulasimani* rosaries. When a Hindu dies, his head is washed with water in which are placed Tulasi leaves and Sesamum seeds, and a sprig of the plant is placed upon his breast as a viaticum. According to the *Kriyáyogasaras,* the devout worshipper of the Tulasi is privileged to ascend to Vishnu's paradise accompanied by 10 millions of his kindred. The wretch who destroys the plant is abhorred of Vishnu, and can never hope for any prosperity; it may only be plucked for religious or medicinal use and when offering the following prayer:—"Mother Tulasi, who brings joy to the heart of Govindas, I gather thee for the worship of Narayana; without thee, O blessed one, every work is vain; that is why I pluck thee; O goddess, be propitious to me. As I gather thee with care, be merciful to me, O Tulasi, mother of the world, I beseech thee."

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In worshipping the plant, it is addressed as the goddess Sri or Lakshmi—

> Sakhi, Subhe, Pápahárini, Punyade, Namaste,
> Náradanute, Náráyanamahâhpriye !
> O beloved, O beautiful, O destroyer of the wicked, O purifier;
> Honour to thee, O distinguished of Nárada, O dear to the heart of Vishnu!

The goddess is besought to protect the head (*çiras*), the forehead (*vhâlam*), the sight (*driças*), the nose (*grâhnam*) in her quality of *sugandha* or perfumed, the face (*mukham*) in her quality of *sumukhi* or fair of face, the tongue, the neck, the shoulders, the body (*madhyam*) in its quality of *punyadâ*, &c., down to the feet. (*De Gubernatis.*)

The Tulasi plant may be often seen occupying a prominent position in front of Hindu houses; when thus kept it has to be watered and worshipped daily. It is often grown on the top of the Brundavanas* or square brick structures erected in the outer courts of temples, and in Calcutta, even in European compounds, there is hardly a hut occupied by a Darwán or Ooriya bearer without a pot of Tulsi close to the door. Frequently in the evenings a light is kept burning near the plant. Sanskrit writers make two varieties of this plant (founded upon some difference in the colour of their leaves), namely, white and black; the plant, irrespective of colour, is called in Sanskrit Tulasi and Parnasa. According to the *Raja Nirghanta*, it removes cold, destroys intestinal worms and evil spirits, and alleviates vomiting.

The leaves are said to be expectorant, and are prescribed in catarrhal affections. The dried leaves powdered are used as a snuff in a disease called *peenash* (ozœna). Ainslie mentions the use of the root in decoction in febrile affections. In the Concan a decoction of the leaves with the flowers of *Careya arborea* and black pepper is given in remittent fever. Tulasi is also an ingredient in prescriptions for rheumatism. (See *Vitex trifolia.*) The seeds are mucilaginous and demulcent.

* वृन्दावन (Vrindavana) is a raised platform of earth or masonry on which the worshippers of Krishna plant and preserve the Tulasi.

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Description.—Stem short, woody, perennial; branches numerous, opposite, round, usually dark-purple, hairy; leaves opposite, petioled, oval, serrate, downy, about 1½ inch long and 1 inch broad; racemes terminal, erect, usually dark-purple, hairy, 4-sided; bracts opposite, petioled, cordate, reflex, 3-flowered; seeds black, oblong, about $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, blunt-pointed.

Other labiate plants, officinal in the East on account of their mucilaginous nutlets, are:—

Salvia plebeia, *Br.*, and **S. ægyptiaca,** *Linn.* var. *pumila* Bth. *Dcne. in Jacq. Voy. Bot.* 128, *t.* 133. The former plant is common in many parts of India, and the latter in the Salt Range and Trans-Indus, extending to Sind and Beluchistan.

The nutlets of *S. plebeia* are very small, $\frac{1}{30}$ of an inch long, ellipsoid, smooth, and of a brown colour; they are valued on account of their mucilaginous properties, and are administered internally in gonorrhœa. They are supposed to have strengthening properties, and are given to promote the sexual powers like many other mucilaginous drugs. The statement that they are used for killing vermin is a mistake. The plant is known as *Sathi* and *Samundar-sok* in the Punjab and Sind, and the seeds are sold in the bazars under the name of *Kammar-kas* or "strong-back." Theophrastus (II. P. ix., 19) mentions a *κραταίογονος* or "strong-back" which has not been identified. The Greeks were acquainted with *S. officinalis*, the *Elelisphakos* or *Sphakos* of Theophrastus (II. P. vi., 1, 2), and the *Elelisphakia* of modern Greece.

The nutlets of *S. ægyptiaca* var. *pumila* are much larger ($\frac{1}{12}$ of an inch), and are used in the north of India as a substitute for *Tukm-i-bálung*.

Chemical composition.—The seeds of *S. plebeia* have the following composition:—Water, 10·44; oil, 18·68; albuminoids, 11·90; gum and fibre, 48·98; ash, 15 per cent. No alkaloid is present. The nitrogen amounts to 1·88 per cent.

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Lallemantia Royleana, *Benth.*, furnishes the nutlets sold in the bazars as *Tukm-i-bálung.* It is a plant of the Salt Range and Trans-Indus, extending to Persia, from whence the drug is imported *viâ* Bombay.

As met with in commerce, they are black, $\frac{1}{8}$ of an inch in length, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot; one side of the seed is broader than the other two, and slightly arched. The seeds when moistened become immediately coated with a tenacious, opaque, tasteless, grey mucilage.

Under the name of *Faranjmishk* or *Biranjmishk*, Arabic forms of the Persian name *Palangmishk*, the nutlets of an unidentified labiate plant are imported from Persia.

They are about $\frac{1}{12}$ of an inch in length, brown, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot. When moistened they become coated with a transparent mucilage. The taste is feebly pungent.

The plant from which they are said to be obtained is described by Persian medical writers as having a clove-like odour, on which account it is often called *Karanful-i-bustani*, "garden clove." According to Abu Hanifeh, it is the same as the plant called by the Arabs *Asâba-el-fatiyát* (*Calamintha Clinopodium*, Benth., the Wild Basil). It is considered to be cephalic, astringent, cardiacal, tonic, and carminative.

COLEUS AROMATICUS, *Benth.*

Fig.—*Wight Ill. ii., t.* 175; *Bot. Reg., t.* 1520. Country Borage (*Eng.*).

Hab.—Moluccas. Cultivated throughout India and Ceylon. The leaves.

Vernacular.—Páthar-chúr (*Hind., Beng.*), Pán-ova (*Mar.*).

History, Uses, &c.—This plant, found in every Indian garden, is the *Coleus aromaticus* of Loureiro, who describes it as resolvent, tonic and cephalic, and useful in asthma and chronic

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cough; also in epileptic and convulsive affections. Roxburgh (*Fl. Ind.*, iii., 22) remarks that the leaves and all parts of the plant are delightfully fragrant, they are frequently eaten with bread and butter, also bruised and put into country beer, cool tankards, &c., being an excellent substitute for Borage. Amongst the natives of India the juice is a domestic remedy in colic and dyspepsia, and the crushed leaves are applied to relieve the pain and irritation caused by the sting of the centipede. The chopped leaves, made into pellets and dipped in a paste made of the flour of the chickpea, are fried in butter and eaten. Food prepared in this manner is a favorite Indian dish and is called भजें (*bhajen*). Dr. Wight speaks of the plant as a powerful aromatic carminative, given in cases of colic in children, in the treatment of which the expresssd juice is prescribed mixed with sugar or other suitable vehicle. In his own practice he observed it to produce so decidedly an intoxicating effect that the patient, a European lady, who had taken it on native advice for dyspepsia, had to discontinue it, though otherwise benefiting under its use. The Rev. J. Long (*Journ. Agri-Hort. Soc., Ind.*, 1858, x., p. 23) also notices its intoxicating properties. In the *Dict. Econ. Prod. of India*, ii., 504, it is stated on the authority of Dr. A. C. Mookerjee that the expressed juice of the leaves is considered an anodyne and astringent, and is applied round the orbit in cases of conjunctivitis. One of us has taken large doses of the fresh juice of the leaves without observing any intoxicating effect, and Mr. J. G. Prebble, who has experimented with a *succus* prepared from the fresh herb, informs us that in large and repeated doses it did not produce the slightest intoxicating effect. The *succus*, a sample of which he has kindly supplied, had the smell and taste of weak infusion of liquorice root.

Description.—The leaves of *C. aromaticus*, which are broad, ovate-crenated, and very thick, are about 3 inches long, and thickly studded with hairs, which on the upper-surface are principally jointed and tapering, but a few are simple and surmounted by a globular, transparent, brilliant gland like a minute dewdrop. On the under-surface the glandular hairs are most numerous, and give rise to a frosted appearance. The

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epidermis is provided with numerous simple stomata. The venation is reticulate, and remarkably prominent on the under-surface of the leaf. A few oil globules are met with in the parenchyma, but the aroma is chiefly situated in the glandular hairs. The taste of the leaf is at first pleasantly aromatic, afterwards very pungent; the odour is agreeable and refreshing.

ANISOCHILUS CARNOSUS, *Wall.*

Fig.—*Wight Ill., t.* 176 *b, f.* 1; *Linn. Amæn. Acad. x.*, 56, *t.* 3; *Rheede, Hort. Mal. x., t.* 90.

Hab.—Western Himalaya, Central and Southern India. The leaves and essential oil.

Vernacular.—Pán-jira (*Hind.*), Kápúrli, Pán-jiren (*Mar.*), Karppúra-valli (*Tam.*), Roga-chettu, Omamu-aku (*Tel.*), Cho-mara, Kúrkha (*Mal.*), Dodda-patri (*Can.*).

History, Uses, &c.—Ainslie states that the fresh juice of the leaves mixed with sugar-candy is prescribed by the Tamil physicians in cynanche, who also prepare with it, in conjunction with the juices of other herbs and gingelly oil, a cooling liniment for the head. Dr. G. Bidie (*Madras Quart. Med. Journ.*, 1862, Vol. V., p. 269) describes it as a mild stimulant expectorant. Its properties depend upon a volatile oil.

In the *Dict. Econ. Prod. of India* it is stated on the authority of Surgeon-Major North that the juice of the leaves mixed with sugar and human milk is a popular domestic remedy for children's coughs in Mysore.

Description.—Stem erect, tetragonal; leaves petioled, ovate-rounded, obtuse crenated, cordate at the base, or rounded, thick, fleshy, hoary and tomentose, or villous on both sides; spikes long peduncled, at length cylindric; floral leaves ovate-obtuse; upper lip of calyx acute, glabrous, membranaceous, ciliated on the margin; lower lip truncate, quite entire; corolla bilabiate; upper lip bluntly 3 to 4-cleft, lower lip entire; flowers lilac.

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LAVANDULA STŒCHAS, *Linn.*

Fig.—*Barrel. Ic., t.* 301. Arabian or French Lavender (*Eng.*), Stœchas Arabique (*Fr.*).

Hab.— Mediterranean Coasts to Asia Minor and Arabia. The flower spikes.

Vernacular.—Dhâru (*Hind.*), Ustukhudus (*Ind. Bazars*).

History, Uses, &c.—Dioscorides states that this plant is called Stœchas from its growing on the Stœchades, a group of islands on the South Coast of Gaul near Massilia, now called Isles d'Hyères. It is the اسطوخودوس or اسطيخوقوس of Ibn Sina. It is much used by Mahometan physicians, who consider it to be cephalic, resolvent, deobstruent and carminative, and prescribe it in chest affections; they also think that it assists in expelling bilious and phlegmatic humors. (Cf. *Dios.* iii., 28; *Paul. Æg.* vi.; *Plin.* 26, 27.)

The author of the *Makhzan-el-Adwiya* devotes a whole folio page to a description of its properties, and especially enlarges upon its cephalic virtues; he concludes by saying, "In short Ustukhudus is the broom of the brain, it sweeps away all phlegmatic impurities, and removes obstructions, strengthening its powers, expelling vain crudities, and rarifying the intellect."

In Western India the drug is best known, though incorrectly, under the Portuguese name of Alfazema,* which is corrupted by the natives into Alphajan. In European medicine the flowers furnish the base of the *sirop de stœchas composé*, and are sometimes distilled for the sake of their essential oil, which is known as "false oil of Spike," the true oil of Spike being the produce of *L. Spica.*

L. Stœchas is known in Spain as "Romero Santo" (sacred rosemary). Its essential oil (also that of *L. dentata*) is there obtained for household use by suspending the fresh flowering

* *Lavandula vera, L. Stœchas,* is called Rosmarinho by the Portuguese in Europe.

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stalks, flowers downward, in closed bottles and exposing them for some time in the sun's rays; a mixture of water and essential oil collects at the bottom, which is used as a hæmostatic and for cleansing wounds. (*J. C. Sawer.*)

Description.—The purple flowers occur in short-stalked spikes and are situated in the axils of downy, heart-shaped bracts. The upper bracts, which are abortive, form a purple tuft at the top of the spike. The drug has a camphoraceous odour and a hot bitter taste. The odour of the oil, which is of a reddish-yellow colour, recalls that of oil of rosemary.

Chemical composition.—The specific gravity of Spanish oil of *L. Stœchas* is 0·942 at 15° C. It boils between 180° and 245°. (*J. C. Sawer, Chem. and Druggist*, 1891, No. 567.)

Commerce.—The drug is largely imported from Europe. Value, Rs. 8 per maund of 37½ lbs.

JADEH.

The جعدة of the Arabian physicians is generally considered to be the Fuliyun (πόλιον) of the Greeks; by some supposed to be the Poley-Germander (*Teucrium Polium*, Linn.); it is described as deobstruent, diuretic, anthelmintic, and tonic. (*Diosc.* iii., 115; *Plin.*, 21, 60, 84.) Dumolin, however, maintains the πόλιον of the Greeks and the Polium of Pliny to be *Santolina chamæcyparissus*, the "Lavender Cotton" of our gardens. Ibn Sina describes Jadeh as نوع من الشيح, "a kind of wormseed." Persian writers on *Materia Medica* give *Gul-i-urba* and *Amberbed* as its synonyms.

Dr. Jayakar, Civil Surgeon at Muscat, and a distinguished Arabic scholar, forwarded to one of us in 1885 a plant growing on the hills near that town which is called Jadeh, and also a specimen of the Jadeh of the Muscat shops which comes from Bandar Abbas. Both of Dr. Jayakar's specimens are woody, labiate plants, with linear leaves and terminal crowded spikes of flowers, both are densely covered with a cotton-like down, more especially the Persian specimen. The two plants are evidently

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very closely related; they are used in febrile affections by the Arabs, one ounce being steeped in cold water all night, and the infusion strained and taken in the morning. In infantile fevers the body is fumigated with the drug.

The specimens were forwarded to Kew, but have not, as far as we know, been identified. The Bander Abbas Jadeh, as sold in the shops, consists of the flowers mixed with a few leaves and stems. The flowers are about $\frac{3}{16}$ of an inch long, and only protrude a little from the cottony calyx; they are permanent and firmly attached to the seeds, which are black, rugose, and somewhat kidney-shaped. The odour of the drug somewhat resembles that of wormseed, while that of the Arabian plant is more like lavender.

POGOSTEMON PARVIFLORUS, *Benth.*

Syn.—*P. purpuricaulis*, Dalz. in *Hook. Kew Journ. ii.*, 336.

Hab.—Sub-tropical Himalaya, Deccan Peninsula. The root and leaves.

Vernacular.—Pangala, Phangala (*Mar.*).

History, Uses, &c.—This plant hardly differs from *P. purpurascens*, and is very closely related to *P. plectranthoides*, *P. glaber*, and the variety *suavis* of *P. Patchouli.* It does not appear to be mentioned by Sanskrit medical writers, but the root has a popular reputation as a styptic. In the Ratnagiri District of Western India, the root has long been in use amongst the natives as a secret remedy for the bite of the Phúrsa snake, and in February 1871, Mr. H. B. Boswell, the Collector, addressed the Civil Surgeon in the following terms:—"I have the honor to send you a specimen of a root which I have reason to believe to be a cure for the bite of the Phúrsa snake, and I shall feel very much obliged to you if you can in any way ascertain its medicinal properties and its effect on any one so bitten.

"It is said to stop all the after ill-effects of this poisonous bite, which is more than Liquor Ammoniæ will, I believe,

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often do. The patient is to eat as much of it, after it has been washed, as would make in bulk the size of the first joint of one's first finger. This he is to do three times a day for seven days. It is also to be applied externally to the wound. I cannot, of course, vouch for the truth of this, or the efficacy of the cure, but one of my sepoys, who was bitten by a Phúrsa a week ago, has been doctored by the *Patel* (village headman) of this place, in this manner, and is now apparently well. The *Patel* after much persuasion has shown me the root and the plant, one I know well, but the name of which I am not at liberty at present to mention. He also assures me that this is all he uses."

The plant was forwarded in April 1871 to the Chemical Analyser to Government, who identified it as a species of *Perilla*, and expressed an opinion that it was highly improbable that a plant belonging to the Labiatæ would prove to be a specific for snake-poisoning, and suggested that some trustworthy evidence of its value should be obtained before he undertook an analysis. In June of the same year, Dr. C. Joynt, the Civil Surgeon, reported the following case:—"A sepoy, aged 27, was admitted on the night of the 29th; Liquor Ammoniæ was applied to the wound after incising; next morning there was hæmorrhage from the wound, and also free hæmorrhage from the gums and tongue, the blood escaping had a bright arterial hue. A scruple of the root was ordered three times a day. The first dose decidedly relieved the vertigo which he complained of, and next day there was a marked diminution in the hæmorrhage from gums and tongue, which entirely ceased on the fourth day. No other medicine was given." Dr. Joynt remarked:—"The employment of the root in this case appears to have been singularly beneficial, and to deserve further investigation."

Unfortunately, Dr. Joynt left Ratnagiri shortly afterwards and was unable to continue his investigations. In the Annual Report of the Ratnagiri Police Hospital for the year 1873-74, the following remarks by Dr. E. H. R. Langley, the Civil Surgeon, occur:—"Snake-bites furnished two cases; these injuries were caused by snakes called 'Phúrsa' by the natives (*Echis carinata* of ophiologists). A rapid cure was effected by

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the internal administration, together with local application of the root of a shrub, 'the *Pogostemon purpuricaulis,*' very common all over the Concan." In 1874 Dr. Langley made the following report to the Deputy Surgeon-General:—"Thirteen cases arising from the bites of poisonous snakes were treated in the Civil Hospital, Ratnagiri. The only remedy used was the pounded root of a plant called *Pangla,* the '*Pogostemon purpuricaulis* of botanists'; the root of this plant is given internally as well as applied as a paste locally; all these cases did well, and were discharged from two to four days after admission."

In 1884 Dr. H. McCalman, Civil Surgeon, Ratnagiri, forwarded a communication, "*On the treatment of Phoorsa bite by Pangla root with illustrative case,*" to the Bombay Medical and Physical Society, from which we extract the following remarks:—"The *Echis carinata,* a viperine snake, is very common in the Ratnagiri District. Fayrer describes it as fierce, active and aggressive, always on the defensive, and ready to attack. The bite is eventually highly dangerous, although the symptoms may be slow in developing. In fatal cases death usually occurs in from 4 to 6 days, and is preceded by giddiness, great lethargy and depression, hæmorrhagic discharges, albuminuria, and occasionally lockjaw." * * *
"Pangla root, chewed in a fresh state, has been used for some years by Drs. Joynt, Langley, Barker and myself in the treatment of Phoorsa bite, and with invariable success."

The following is Dr. McCalman's illustrative case:—Rowjee Balsawant, Hindoo, police constable, aged 45, was admitted to hospital on the 14th June 1884, at 6 A.M. An hour previously he was bitten on the dorsum of the foot by a Phoorsa snake, afterwards recognized and killed. He was immediately given Pangla to chew, and a poultice of the leaves applied locally. At 9 A.M. there was much pain in the part, œdematous swelling of the foot and ankle, extending half-way up the leg, giddiness, a feeling of great depression, and hæmorrhage (dark-coloured) from the gums, under surface of the tongue and buccal mucous membrane generally. The blood expectorated did not coagulate. This bleeding had begun at

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6 A.M., an hour after the man had been bitten. Pulse 72, temperature 98° F., no dyspnœa. Finding the hæmorrhage unchecked by the remedy, some perfectly fresh root just dug up was substituted for that first given. The effect was soon apparent.

At 2 P.M., giddiness less, pulse 78, temperature 99°, expression tranquil, urine dark-coloured, depositing a slight flocculent sediment, reaction acid, sp. gr. 1012, albumen to a considerable extent. Pain of the foot less.

6 P.M., bleeding from the mouth practically stopped, giddiness increased, pulse 72, temperature 99°·4. Urine shows blood corpuscules under the microscope.

15th.—No hæmorrhage from the mouth; urine contains a considerable quantity of blood; vertigo less. Swelling of limb less. Pulse as yesterday and of fair volume.

16th.—No hæmorrhage whatever. No giddiness. Urine pale, no sediment, no albumen, sp. gr. 1008. Pulse 66. Stiffness of foot, but no real pain.

17th.—Swelling rapidly disappearing. No head symptoms. Urine very pale and plentiful, sp. gr. 1004.

18th.—Pangla omitted. His convalescence was uninterrupted, and he left the hospital on the 22nd perfectly well.

Dr. McCalman remarks:—"I do not pretend to explain the action of Pangla; that the remedy acts generally and physiologically is apparent from the early drying up of remote hæmorrhages (*e.g.*, bleeding from the urinary tract) and the relief of cerebral symptoms, effects due to a restoration of the natural state of the blood, and, through it, of the nervous centres. The drug may also stimulate organs concerned in the elimination of the poison. The subject is one which calls for further careful experimental research."

Through the courtesy of Surgeon-General Pinkerton we have been supplied with further extracts from the records of the Ratnagiri Civil Hospital, which show that Pangla root is still used with the same success in the treatment of Phúrsa bite.

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Only one fatal case is recorded, and in that the remedy was administered in the form of tincture instead of in the usual manner.

Mr. G. W. Vidal, C.S., in a letter to the *Bombay Gazette*, dated January 30th, 1890, states that the bite of the Phúrsa snake is apparently fatal in about 20 per cent. of cases, and the action of the poison is slow. He says: "In collecting materials for an account of the snakes of Ratnagiri for the *Bombay Gazetteer*, I found (in 1878) records of 62 fatal cases treated at the Civil Hospital. These cases showed that death occurred on an average in four and a half days, though in some instances patients had lingered up to twenty days." In 1855-56 Dr. Imlach, then Civil Surgeon of Shikarpur, in a description of the 'Kapar' (*Echis carinata*), published in the *Transactions of the Bombay Medical and Physical Society* (Vol. iii., New Series, p. 80), wrote that "a reference to police returns will show that in by far the majority of cases serious injury and death have been caused by the bite of this species." In an article upon the "Venomous Snakes of North Canara" (*Journ. Nat. Hist. Soc. Bombay*, Vol. v., No. 1, p. 69), Mr. Vidal says:—"There is indeed no doubt that the *Echis* is a far more potent factor than any other venomous snake in swelling the mortality of the Bombay Presidency, and it is important that this fact should be more generally known and recognised than it has been hitherto. It is, of course, impossible to show the exact percentage of the deaths from snake-bite for which the *Echis* is responsible. In the returns no attempt is made to discriminate the species to which the recorded deaths are attributable, and little if any reliance could be placed in the statistics, even if such an attempt were made. But the conclusion stated above may, I think, be fairly drawn from the fact, which is very clear from the returns in their present shape, that in all those districts, where the *Echis* is known to abound, the average mortality from the snake-bite is *markedly* high, while conversely, the mortality is insignificant in other districts where the *Echis* is either rare or absent. The following table, which I have compiled with some care and labour from the official returns for the eight years, 1878—85, shows the

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population, the actual average mortality, and the mortality per *mille* of each district in the Bombay Presidency :—

District.	Population by Census of 1881.	Average actual mortality from snake-bite, 1878 to 1885.	Average mortality per *mille*, 1878 to 1885.
Hydrabad	754,624	181 7	0·247
Thar and Parkar	203,344	48·7	0·239
Karachi	478,688	87·2	0·182
Ratnagiri	997,090	154·5	0·155
Thana	908,548	108·8	0·119
Panch Mahals	255,479	30·5	0·119
Shikarpur	852,986	72·8	0·085
Surat	614,198	41·5	0·067
Kaira	804,800	47·2	0·0586
Broach	326,930	19·1	0 0584
Upper Sind Frontier	124,181	6·7	0·053
Kolaba	381,649	19·8	0·052
Ahmedabad	856,324	39·6	0·046
Sattara	1,062,350	41·0	0·038
Kanara	421,840	16·0	0·037
Belgaum	864,014	30·2	0·034
Poona	900,621	18·6	0·020
Dharwar	882,907	17·6	0·019
Khandeish	1,237,231	23·1	0·018
Bijapur	638,493	11·0	0·017
Nasik	781,206	10 8	0·0138
Ahmednagar	751,228	10·3	0·0137
Sholapur	582,487	2·2	0 003

Thus three Sind districts and Ratnagiri, in all of which the *Echis* swarms in suitable localities, stand well at the top of the list with an average mortality, taking the four districts together of ·205 per 1,000. On the other hand, in the last four districts on the list, *viz.*, Bijapur, Nasik, Ahmednagar and Sholapur, the combined average mortality per *mille* is only ·0118. In other words only one man dies of snake-bite in about 100,000 in these Deccan districts, while in the *Echis*-ridden tracts one man dies in every 5,000. Daboias and kraits are probably nowhere so common in Western India as to have much appreciable effect on the mortality. But cobras are quite as common, I believe, in these Deccan districts as they are in Ratnagiri or

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Sind. This shows, I think, pretty conclusively that the *Echis* —and not the cobra, or any other venomous snake—is chiefly responsible for deaths from snake-bite in Bombay."

The fresh leaves of *P. parviflorus* have a pungent taste, and when bruised are in general use in the Concan as a cataplasm to clean wounds and sores, and to stimulate healthy granulation.

Description.—A stout, erect, branched shrubby plant; glabrous, pubescent, or scaberulous. Leaves long-petioled, ovate or ovate-lanceolate, singly or doubly crenate-toothed or serrate, base cuneate, whorls subglobose, in dense cylindric or one-sided softly hairy spikes, bracts elliptic-ovate, exceeding the hirsute calyx, calyx-teeth short, triangular-lanceolate, ciliate. Nutlets very small, black, shining. The whole plant has a strong black currant odour. Roots woody, knotted; bark light brown, scabrous, with an aromatic odour like that of the plant, and a pungent taste, benumbing the tongue and palate when chewed.

Chemical composition.—The most interesting principle detected in the plant was an alkaloid. After repeated purification it was left as a yellow varnish with slightly bitter and mouse-like flavour. It was more soluble in chloroform than in ether. No special colour reactions were noted. We also detected the presence of trimethylamine, and a volatile principle with a cedar-wood odour. Resinous principles were also present, with astringent matter. We provisionally call the alkaloid *Pogostemonine.*

MENTHA SYLVESTRIS, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 82; *Eng. Bot.* 686. Wild Mint (*Eng.*), Menthe sauvage (*Fr.*).

Hab.—Temperate W. Himalaya, Persia. The herb.

Vernacular.—Pudína or Púdina (*Hind., Tam., Beng., Guz.*), Chetni-maragu (*Can.*), Vatalau, Pudína (*Mar.*).

History, Uses, &c.—A fragrant plant named μίνθα or μίνθη, in Latin Mintha or Mentha, was known to the Greeks and Romans (*Theophr.*, ii., 4; *Plin.*, 19, 47; 20, 53), which was

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probably a kind of mint. According to Pliny, the name of this plant was afterwards changed to *ἡδύοσμον* on account of the sweetness of its smell. It was used as an ingredient in sauces and for medicinal purposes; it is impossible to determine with certainty which species of mint was used by the ancients, but it is generally supposed to have been *M. sativa*, Linn.

Ovid tells us that Myntha was a nymph beloved of Pluto, who was turned into a plant by Proserpine out of jealousy. De Gubernatis (*Myth. des Plant.*, ii., 226) says:—"Les Français l'appellent *Menthe de Nostre Dame*, les Allemands *Unser Frauen Müntz*, Pietro de Crescenzi, *Herba sanctæ Mariæ*. Dans la *Naturale et generale Historia dell' Indie Occidentali* (Ramusio) on lit: "L'*herba buona*, che in alcune parti chiamano *herba santa*, e in molto altre *menta*." Dans les *Allégories d'Azz Eddin*, traduit par Garcin de Tassy, la menthe semble jouer, au contraire, un assez vilain rôle. Le basilic en parle ainsi au jasmin: "Tu auras peut-être entendu dire qu'il existe un délateur (la menthe) parmi les êtres de mon espèce; mais, je t'en prie, ne lui fais pas de reproches; il ne répand que sa propre odeur; il ne divulgue qu'un secret qui le regarde; il ne dévoile enfin que ce qu'il peut découvrir." Quelle allusion peut contenir cette allégorie? Est-il possible que la vieille équivoque latine entre les mots *mentha* et *mentula* se soit répétée dans une langue orientale? * Quant à la première, elle est certaine, et les poètes pornographiques italiens en ont bien abusé. Il faut sans doute encore songer à cette équivoque, pour comprendre l'origine de la superstition Sicilienne de Caltavuturo, dans la province de Palerme; on y croit que si la femme dans ses mois s'approche de la menthe, la plante périra; autrefois, au lieu de *menta*, on entendait probablement *mentula:* d'où la croyance qui, autrement, serait inintelligible.

Apulée, *De Virtutibus Herbarum*, indique le rite qu'il faut suivre pour cueillir la menthe: "Lege eam mense Augusto, mane primo priusquam sol exeat, mundus, ad omnia sic dicens: Te precor, herba *hedyosmos*, per eum qui nasci te jussit, venias ad me

* Immovero sic est, نعنع idem valet.

hilaris cum tuis virtutibus et effectu tuo, et ea mihi præstes quæ fide a te posco."

Mint does not appear to be mentioned by Sanskrit medical writers. In Arabic نعنع (*naanaa*) and حبق (*habak*) are general names for the mints, but they are best known as Fudanaj, the Arabic form of the Persian word Púdina or Púdang. The author of the *Makhzan* describes three kinds of Fúdanaj, wild, mountain, and water mint; the latter, he says, is the Calamintha of the Greeks. Mountain mint is described as having hoary leaves, but it is impossible from his description to form any opinion as to the exact species to which he refers. The mints are considered to be hot and dry, and are prescribed in dyspeptic affections, fluxes, and dropsy. Different kinds of mint are much cultivated in Indian gardens, and are used as domestic remedies on account of their stimulant and carminative properties. They are often made into a medicinal *chutney*, which is eaten to remove a bad taste in the mouth in febrile conditions of the body, *e.g.*, Púdína, khárik (dry dates), black pepper, rock salt, raisins, and cumin in equal proportions are rubbed into a chutney with limejuice.

In colic, mint juice with a little black pepper and honey is given.

Description.—*M. sylvestris* has leaves broadly or narrowly oblong, obovate or lanceolate subacute, serrate, hoary beneath, whorls in terminal spikes, calyx-teeth triangular or lanceolate, corolla hairy, glabrous within. Nutlets usually pale, smooth, sometimes brown and delicately reticulate. (*Fl. Br. Ind.*)

The plant varies much in size and habit. Aitchison observed it in Biluchistan in beds of streams amongst tamarisk shrubs, growing nearly seven feet high and forming large clumps. Another variety was collected by him on the Harirud valley.

Mentha viridis (spear-mint), *M. piperita* and *M. incana* (peppermint), *M. sativa*, and *M. aquatica*, occur in Indian gardens, and as escapes. *M. arvensis* is a native of the Western Himalaya.

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Chemical composition.—The most important constituent is the volatile oil, which has the same composition as oil of peppermint, but differs from it in odour and flavour (see p. 107).

The plant contains a little tannin.

Commerce.—The dried plant of *M. sylvestris* is a regular article of import from Persia into Bombay. Value about 2 annas per lb.

MENTHA ARVENSIS, *Linn*, var. *piperascens*.

Hab.—China and Japan. The essential oil, and Menthol or Peppermint camphor.

Vernacular.—The oil.—Lin-tsao (*Chin.*), Hakano Abura (*Japan*), Púdine-ka-tél *or* atar (*Hind.*, *Beng.*), Vatalau-cha-tél (*Mar.*), Phudino-nu-tél (*Guz.*), Pudina attar *or* tailam (*Tam.*), Pudina-attaru *or* tailamu (*Tel.*), Pudina-attar *or* yanne (*Can.*). Menthol.—Po-ho-yo (*Chin.*), Hatsca (*Japan*), Pudine-ke- phúl (*Ind. Bazars*).

History, Uses, &c.—Peppermint was in use in China and Japan at least 2,000 years ago. The Fudanaj-el-tays, "Mentha hircina," of Ibn Sina appears to have been peppermint; he describes it as a very efficacious kind of mint and a good diuretic. Haji Zein el-attar (1368) mentions a kind of mint called Filfilmún, *i.e.*, "having the qualities of pepper," also known as Púdineh-i-kohi or "hill mint." Both the Arabs and Persians appear to have been well acquainted with the value of this mint in neuralgic affections. It is interesting to observe that in Hull's *British Flora*, Manchester, 1799, peppermint is named *Mentha hircina.* Peppermint is not mentioned by Sanskrit writers on *Materia Medica.* From the *Pharmacographia* we learn that *peper-mint* was first observed by Dr. Eales and communicated to Ray, who noticed it in his *Synopsis* in 1696. Dale, in 1705, states in his *Pharmacologiæ Supplementum* that it is esteemed a specific in renal and vesical calculus; and Ray, in the third edition of his *Synopsis*, declares it superior to all other mints as a remedy for weakness of the stomach and for diarrhœa.

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Upon the Continent of Europe peppermint became practically known about the latter end of the last century (*op. cit.*, 2*nd ed.*, p. 481). Peppermint camphor was first described by Gmelin in 1829, who obtained it from the European plant. Pereira and Guibourt notice the menthol of China, and in 1862 a memoir on crystallized oil of peppermint from Japan was presented to the Chemical Society by Oppenheim, who speaks of it as coming to Europe in earthenware jars, and often adulterated with sulphate of magnesium to the extent of 10 to 20 per cent This, however, was not the case with a sample examined by Moss and also by G. H. Beckett and C. R. Alder Wright in 1874. When first brought to Europe it was used as a remedy for headache and neuralgia, and was known in France as *Gouttes Japonaises.* In 1879 Mr. Archibald Duncan, a student of the University of Edinburgh, drew attention in the *Lancet* to its value as an antiseptic. Dr. A. Rosenberg (*Lancet*, 1885) recommended an alcoholic or ethereal solution as a local anæsthetic in affections of the nose, pharynx, and larynx. The use of menthol for these purposes has now become general in Europe and America. Dr. Lahnstein (*Therap. Monatsh.*, 1890, No. 5) has used menthol with striking success against vomiting in a child with traumatic peritonitis where opium and morphine had failed.

Dr. Drews (*Therap. Monatsh.*, 1890, No. 7) has conditionally confirmed the communications of Gottschalk and Weiss concerning its value in obstinate vomiting of pregnancy.

Dr. Bronner of Bradford reported at the 62nd meeting of German Scientists and Physicians in Heidelburg on the success obtained by him with menthol (a few drops of a 20 per cent. solution in olive oil poured on pieces of pumice stone) in obstinate swelling of the tubes as well as in some cases of sclerosis. (*Therap. Monatsh.*, 1890, No. 8.)

Dr. Jones (*Deutsch. Apoth-Zeit.*, 1890, p. 143) has used menthol successfully in 20 per cent. alcoholic solution for inhalation in asthmatic cases. Lastly, the success obtained with menthol against diphtheria must be mentioned.

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Dr. Hermann Wolff (*Therap. Monatsh.*, 1890, No. 9) has exhaustively reported on his experience of two years with the treatment. In India it is chiefly used as a stimulant carminative by vegetarians in the same manner as the essential oil of peppermint, which is largely imported from China and Japan. One of us has found a large rectal injection of essence of peppermint in warm water afford marked relief in renal colic.

Description.—Chinese oil of peppermint is generally high coloured and very pungent, with a bitter after-taste. It is now often deprived of its menthol, but still appears to be unable to compete with the Japanese oil which has nearly driven it from the Indian market. The menthol of China and Japan occurs in long hexagonal crystals, resembling sulphate of magnesium, which contain much water. E. B. Kyle (*Amer. Journ. of Pharm.*, 1885) mentions the following among the properties of menthol. When thrown upon water, currents are produced to and from the dissolving crystals. Menthol liquifies with chloral, thymol, and camphor; and this action is particularly noticeable with thymol, crystals of the two substances placed in contact being in a few minutes transformed into a thick oily liquid. On gently heating a mixture of 1 drachm of the aqueous solution of menthol with half a drachm of a solution of 1 grain of iodine and 5 grains of potassium iodide in two drachms of water, with a small quantity of potash solution, the characteristic odour of iodoform is developed. The aqueous solution is not affected by ferric chloride or bromine water, but yields a slight turbidity with chlorine water. One grain of menthol yields, with 120 drops of sulphuric acid, a brownish red liquid of a very disagreeable odour, and on the addition of a little potassium bichromate becomes chrome-green, the colour remaining unaltered for several weeks. Menthol slightly warmed with nitric acid yields a thick, wine-coloured, oily liquid, and at a higher heat red fumes are given off; on neutralizing now with ammonia, a precipitate is observed which is soluble in alcohol, and the solution when evaporated yields an indistinctly crystalline mass.

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The oil of *M. arvensis;* var. *piperascens*, distilled from the fresh plant, grown at Mitcham, by Moss had a decided yellow colour, and a sp. gr. of ·9107 at 62° F. With the barometer at 30 in. it boiled at 402° F.

The sp. gr. of the oil after determining the boiling point, was found to be ·9117 at 62° F.

Other specimens of oil distilled in England from the dry imported herb, were found by Moss to be different in appearance and physical properties from that distilled by him. One labelled "non-rect." was distinctly green, and had a sp. gr. of ·9167 at 62°F.; a second, labelled "rect.," was pale in colour, with a faint green tinge, and had a sp. gr. of 9098. The sp. gr. of these oils confirm Todd's generalization that pure oils fall between ·908 and ·917. (*Pharm. Journ.*, p. 446, 1886.) None of the three oils gave any coloration when subjected to the test given in Todd's paper above mentioned. It consists in adding one drop of oil to a mixture of 25 drops of alcohol with one drop of nitric acid, sp. gr. 1·2. With the oil of *M. piperita* a permanent blue or bluish-green colour is developed.

Chemical composition.—Oil of peppermint owes its peculiar odour to *menthol* (mint camphor, mint stearopten), $C^{10}H^{20}O$, which is chiefly contained in the last portions obtained on subjecting the oil to fractional distillation. It forms colourless prisms which fuse at 42° C. and boil at 212° C. Distilled with phosphoric anhydride, it yields *menthene* $C^{10}H^{18}$, which is a colourless liquid of an agreeable odour. According to Moriga (1881), oil of peppermint contains probably also an oil of the formula $C^{10}H^{18}O$, which may be prepared from menthol by oxidation with potassium bichromate; but by treatment with fuming nitric acid menthol yields at first an explosive oil, afterward crystals of an acid $(C^5H^8O^4)^2H^2O$, melting at 97°C.; this compound is not identical with pyrotartaric acid, with which it agrees in composition. A compound isomeric with borneol had been found by Beckett and Wright (1875) in the liquid portion of Japanese peppermint oil, but, according to Flückiger and Power (1880), is not present in

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the oil distilled at Mitcham, which contains, besides menthol, several hydrocarbons of the formulas $C^{10}H^{16}$ and $C^{15}H^{24}$, and having a terebinthinate somewhat lemon-like odour. (*Stillé and Maisch.*)

Commerce.—Chinese oil of peppermint and menthol are imported into India in quarter-catty flat bottles, bearing a Chinese label. Four or more of these bottles are packed in a tin box. The Japanese oil is packed in tins of various sizes and has generally an English label, much of it is of very inferior quality, the menthol having been separated. Cocking's is the best brand, and is packed in glass bottles with paper cases. Value—oil, Rs. 4 to 5 per lb.; menthol, Rs. 8 per lb.

Indian substitutes for peppermint are **Mentha incana**, *Willd.*, much cultivated in gardens, and wild in Northern India, and **Micromeria capitellata**, *Benth.*, a native of Behar, the Western Himalaya and the Western Ghâts, described by Dalzell as rivalling the peppermint in its aromatic and carminative properties.

ORIGANUM MARJORANA, *Linn.*

Fig.—*Woodv. Med. Bot. t.* 165. Sweet Marjoram (*Eng.*), Marjolaine (*Fr.*).

Hab.—Portugal to Western Asia. Cultivated in India. The herb.

Vernacular.—Marwa (*Indian Bazars*).

History, Uses, &c.—The name ορίγανον, in modern Greek ριγανι, was applied in ancient times to plants of this genus, but *O. marjorana* was distinguished by the names σαμψυχον and αμαρακος. A Greek myth informs us that Amaracus was a page to the king of Cyprus, who one day on letting fall a vessel of perfume became so frightened that he was turned into this plant. The Greeks and Romans decorated the newly married with it. Catullus says:—

> Cinge tempora floribus
> Suaveolentis Amaraci.

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It is the Marjolaine of the French. De Gubernatis states that in Southern Europe it is the symbol of honour and the protector of married women. It is the Maruva and Jambhira of the Raja Nirghanta and the Marwa or Marzangush of the Persians. Ibn Sina calls it Marzanjush. The Persian word signifies "mouse-ear," a name given to it on account of the greyish downy character of the leaves, which is more marked in the Persian variety than in the European plant. Marjoram is cultivated as a pot-plant in most Indian gardens, and is used as a substitute for thyme in cookery. At Bandora, near Bombay, it is grown as a garden crop to supply *bouquets* for the Bombay market, which are much worn by women in their hair. The medicinal uses of Marjoram in the East are similar to those of mint.

Description.—An annual herb. The leaves are spatulate or oval, very obtuse, entire, gray green, soft-hairy, and pellucid punctate. The flowers are aggregated in small heads and have a small whitish corolla. The plant is agreeably and pungently aromatic.

Chemical composition.—The volatile oil (*Oleum majoranæ*) is thin, yellowish, of the specific gravity 0·89, boils above 163° C., is readily soluble in alcohol, has the aromatic odour of the herb, and, according to Beilstein and E. Wiegand (1882), contains a terpene boiling at 178° C. and forming a liquid compound with HCl; the fraction boiling between 200° and 220° C. has the composition $C^{15}H^{26}O$, and is not affected by metallic sodium. (*Stillé and Maisch.*)

THYMUS SERPYLLUM, *Linn.*

Fig.—*Engl. Bot., xxii., t.* 1514. Wild Thyme (*Eng.*), Serpolet (*Fr.*).

Hab.—Western Temperate Himalaya, Persia, Europe. The herb.

Vernacular.—Másho (*Panj.*), Háshá (*Pers. Ind. Bazars*).

History, Uses, &c.—Háshá is the Persian name of *T. serpyllum*, but it has been adopted by the Arabian and Persian

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physicians as the equivalent of the θύμος of Dioscorides, a plant concerning the identity of which there is much doubt: some supposing it to be the *Satureia capitata* of Linneus, and others the *Thymus vulgaris* or *T. Zygis* of the same botanist. Ibn Sina in his description of Háshá quotes what Dioscorides says concerning θύμος, and does not notice the ἑρπύλλος of the same author usually identified with *T. serpyllum*. Haji Zein el-Attar follows Ibn Sina in identifying Háshá with the θύμος of the Greeks, and describes it as a kind of mountain mint with very numerous small flowers of a purplish colour, slender stems, and leaves like the *Jadeh*. His description of its medicinal properties hardly differs from that of Pliny (21, 89), which is as follows:—"Thyme is considered to be very beneficial to the sight, whether used as an article of food or as a medicament, and to be good for inveterate coughs. Used as an electuary with vinegar and salt, it facilitates expectoration, and taken with honey prevents the blood from coagulating. Applied externally with mustard, it dispels chronic fluxes of the fauces, as well as various affections of the stomach and bowels; still, however, it must be used in moderation, as it is of a heating nature, and acts as an astringent on the bowels. In cases of ulceration of the intestines, the dose should be one denarius of thyme to one sextarius of oxymel; the same proportions, too, should be taken for pains in the sides, between the shoulder-blades, or in the thoracic organs. Taken with oxymel, it is used for the cure of intestinal diseases, and is administered in cases of alienation of the senses and melancholy. Thyme is given also for epilepsy, when the fits come on, the smell of it reviving the patient; it is said, too, that epileptic persons should sleep upon soft thyme. It is good also for hardness of breathing, and for asthma and obstructions of the catamenia. A decoction of thyme water, boiled down to one-third, brings away the dead fœtus, and it is given to males with oxymel, as a remedy for flatulency, and in cases of swelling of the abdomen or testes and of pains in the bladder. Applied with wine, it removes tumours and fluxes, and in combination with vinegar, callosities and warts. Mixed with wine, it is used as an external application

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for sciatica; and beaten up with oil and sprinkled upon wool, it is employed for diseases of the joints and for sprains. It is applied also to burns, mixed with lard. For maladies of the joints of recent date, thyme is administered in drink, in doses of three oboli to three cyathi of oxymel. For loss of appetite it is given beaten up with salt."

The ancients appear to have been acquainted with the antiseptic properties of thyme. Virgil (Georg. IV., 241) speaks of the fumigation of beehives with the smoke of the burning plant, and the name θύμος is derived from θύω, to burn incense. Macer Floridus (*De Vir. Herb*) recommends thyme as a remedy for the bites of venomous animals. In the Punjab the seeds of *T. serpyllum* are given as a vermifuge. (*Stewart.*) The plant is an indifferent substitute for *T. vulgaris*, as it contains hardly any thymol. The latter principle is, however, afforded abundantly by the seeds of *Carum copticum*, a plant largely cultivated in India. Thymol is a powerful antiseptic; when absorbed it paralyses the nerve centres in the cord and medulla, and like carbolic acid lessens reflex action, slowing the respiration, and lowering the blood-pressure and temperature. In poisonous doses it causes weakness, drowsiness, coma and death. It differs from carbolic acid in being less volatile and less easily oxidised. Its action as a disinfectant is more permanent and at the same time more powerful than that of carbolic acid. It is less irritating to the skin or mucous membrane, and does not act as a caustic like carbolic acid, and is a less powerful poison to mammals. Its action on the nerve-centres is a paralysing one from the first, and is not preceded by excitement as in the case of carbolic acid. While in the body it appears to effect tissue-metabolism, for in animals poisoned by it the liver is found quite fatty, as in phosphorus-poisoning. It appears to be eliminated by the respiratory and urinary organs and to cause irritation of these organs during the process of excretion. In poisoning by it, the bronchial mucous membrane is extremely congested, the secretion of mucous increased, the lungs congested, and sometimes consolidated; the kidneys

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inflamed, and the urine albuminous or bloody. Thymol has been used as an antiseptic, as an application to skin diseases, ringworm, eczema, psoriasis; as a gargle, spray, or inhalation in sore-throat, bronchiectasis and phthisis, or as an injection in ozæna. Internally it has been used in diabetes and vesical catarrh. (*Lauder Brunton.*)

Dr. Gross (*Pharm. Zeitsch.*, 1890, p. 261) reports on the successful results obtained with thymol in the treatment of diphtheria, having found it the most effective remedy in 280 cases. He prescribed, according to the age of the child, a 0·1 to 0·3 per cent. solution in doses of 10 to 12 drops every 5 to 10 minutes, according to the severity of the case. The solution was flavoured with some pleasant-tasting syrup and in severe cases a few drops of brandy were added. The children soon become accustomed to the burning taste and willingly take the solution. Besides this there is the advantage that the remedy is perfectly harmless and may be given continually for weeks together. The effect of the treatment in cases of average severity is seen in from 3 to 4 hours.

Thymol is recommended by Küster in whooping-cough in a solution of 1 in 2,000. Three or four times a day he directs this solution to be inhaled by means of an atomiser. According to his experience the cases never assume a violent character when this treatment is begun in time; if, however, the attacks are already frequent and violent they soon diminish in number and severity. The duration of the treatment is between three and four weeks, and healthy children who inhale the spray are protected from whooping-cough. Dr. E. Lawrie (*Lancet*, Feb. 16, 1891) reported two cases of chyluria successfully treated with thymol given internally in doses of one grain every four hours, gradually increased to 5 grains.

Description and Properties.—Thymol crystallizes in thin, colourless, rhombic scales, or is seen in commerce in large translucent crystals of spec. grav. 1·028. It melts between 50° and 52° C. to a colourless liquid lighter than water, retains its fluid condition often for a long time, and boils near 230° C. It

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has an aromatic thyme-like odour and a warm, pungent but scarcely caustic taste. It dissolves sparingly in water, requiring at 15° C. 1,100 to 1,200 parts for solution, but is soluble in half its weight of alcohol, ether, and chloroform, in 2 parts of soda solution sp. gr. 1·16, and freely in benzol, benzin, carbon disulphide, glacial acetic acid, and fixed and volatile oils. It forms with soda a crystallizable and readily soluble compound, and does not change the colour of a solution of ferric chloride. Symes (1879) ascertained that on being triturated with one-half to ten times its weight of camphor, a colourless syrupy liquid is obtained, but it does not liquefy with chloral hydrate. According to Gerrard, the strongest aqueous solution of thymol available is 1 in 1,000, and a solution of 4 grains of it in a fluid ounce of alcohol is miscible with water without becoming turbid; 3 grains of thymol are dissolved by 1 grain of caustic soda and 1¼ grains of caustic potash. Solid fats, when heated, are excellent solvents of thymol. A solution of 1 part of thymol in 100 parts of warm glycerin remains clear. Thymol is also soluble in 4 parts of cold sulphuric acid; the solution has a yellowish colour, and, on being gently heated, becomes rose-red. On pouring this solution into 10 volumes of water, digesting the mixture with an excess of lead carbonate, and filtering, the liquid becomes violet-blue on the addition of ferric chloride. This reaction is due to *sulphothymolic acid*, $C^{10}H^{14}SO^{4}$, discovered by Lallemand (1853). Hammarsten and Robert (1881) give the following as the most delicate test by which one-millionth of thymol may still be detected: Mix the liquid with one-half of its volume of glacial acetic acid, then with at least an equal volume of sulphuric acid, and warm gently, when a bright reddish-violet colour is produced which is not destroyed by boiling. According to Hirschsohn (1881), a solution of thymol in 60,000 parts of water is rendered turbid by bromine-water, but, according to Hammarsten, the precipitate is not crystalline like tribromophenol. (*Stillé and Maisch.*)

Chemical composition.—The volatile oil of *Thymus Serpyllum*, Linn., according to E. Buri (1879), contains two phenols which do not congeal at—10° C., and of which one imparts a yellowish-

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green colour to ferric chloride, and yields a sulphonic acid, the salts of which, like the thymol sulphonates, produce with ferric salts an intense blue colour. Jahns (1880) reported also the presence of a little thymol and carvacrol. Messrs. Schimmel & Co. (Report, April 1891) obtained by distillation of the leaves and stalks 0·3 per cent. of an oil having a very pleasant melissa-like aroma with a slight soupçon of thyme. Its specific gravity at 15° C. was 0·917.

Thymus vulgaris, Linn., is the chief source of thymol in Europe; the essential oil is usually sold under the name of Oleum Origani. For the chemistry of thymol the reader is referred to the article upon *Carum copticum*. (Vol. ii., p. 116.)

Fúdanaj-í-jibali, also called Pudineh-í-kohí, "hill mint," is identified by Mahometan physicians with the Calamintha of the ancients (cf. *Matth. Valgr.* v., 2, 76. *f*), *Calamintha vulgaris*, Sweet, *Eng. Bot.* 1676. We have not met with this drug in the Indian Bazars, but three species of Calamintha occur in the Himalayas.

ZATARIA MULTIFLORA, *Boiss.*

Hab.—Arabia, Persia. The herb in flower.

Vernacular.—Saatar (*Ind. Bazars*).

History, Uses, &c.—The Mahometan physicians of the East identify this drug with the ὀρίγανον of the Greeks, and describe it as having properties similar to those of thyme and mint. Dr. Jayakar of Muscat found the plant in flower in May 1885 on the hills near Muscat in Arabia, and kindly forwarded specimens, which were identified at Kew as *Z. multiflora*. The drug is much used in India in infusion as an agreeable aromatic stimulant and diaphoretic; many other properties are ascribed to it in Persian medical works which it is unnecessary to recapitulate.

Description.—The drug has a fragrant odour like lemon thyme, and consists of small ovate, or nearly round, dotted, entire, rather leathery leaves, the largest of which are about ¼ inch long; mixed with them are portions of a slender woody stem

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and numerous minute flowers, forming knotted clusters upon a slender spike; each flower is furnished with a small bract, and when magnified the bracts and calices are seen to be densely covered with jointed hairs. The calyx is unequally 4-cleft, the corolla labiate, and of a red colour, the calyx and flower after being soaked in water for 24 hours only measured $\frac{1}{8}$ inch in length. The leaves when magnified present a mossy surface, which is thickly pitted, each pit containing a granule of red, resinified essential oil.

Chemical composition.—The leaves contain an aromatic essential oil having a minty odour, a red, tasteless, acid resin, and some tannic acid giving a green precipitate with ferric chloride. The bitterness is not due to an alkaloid. The leaves containing 10 per cent. of moisture yielded 13 per cent. of ash.

ZIZIPHORA TENUIOR, *Linn.*

Hab.—Persia, Beluchistan. The herb.

Vernacular.—Mishk-i-taramashia (*Ind. Bazars*).

History, Uses, &c.—The Mahometans of the East identify this plant with the ζυγις or "wild thyme" of the Greeks. It is the مشكطرامشيع of Ibn Sina, who describes it as very hot and dry. Haji Zein in the *Ikhtiarát* states that it is called Rang in Shiraz, and that the milk of goats feeding upon it becomes bloody. He describes it as a valuable expectorant and lithontriptic in doses of one mithkal, but says that it sometimes causes hæmaturia. He also mentions its use by Galen as a suppository in painful affections of the uterus, and by Ishak as a carminative addition to purgative medicines. The drug is also said to be a powerful aphrodisiac. Aitchison states that the peasants in the Harirud Valley and Khorasan call the plant *Kakuti.*

Description.—A very small plant, 2 to 3 inches high; root as long as the plant, single, woody, with a few small fibres. The stems, which are 2 to 5 in number, are also woody, and branch from the ground; they are thickly set with leaves and

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flowers, which reach to the apex and form a spike. The leaves are linear-lanceolate, and have several prominent straight veins on each side of the midrib. The calyx, which is purple, encloses four oblong seeds of a brown colour, and is marked with numerous ribs, and ends in five sharply cut claws; it is studded with simple hairs, and is $\frac{5}{16}$ths of an inch long. The odour and taste of the drug is pleasant, like peppermint, but sweeter.

Zufah-i-yabis.* From an examination of the drug it appears to be a small plant, 6 to 8 inches high; stem not thicker than a crow-quill, 4-angled, purplish, branched from the base, which is woody; root woody, seldom branched; flower heads numerous, oblong; calyx striated, hairy, purple, with five sharp teeth; seeds naked, four in number, oblong, 3-angled, of a pale brown, studded with rows of small round tubercles; on one side of the hilum there is a fringe of smaller tubercles very closely set, and on the other two elongated white prominences. As found in commerce the plant is much broken up; it has a pleasant odour like sweet hay. Taste bitter; properties, according to native writers, stimulant, anthelmintic, and deobstruent. The drug is generally attributed to *Hyssopus officinalis*, but this cannot be correct, as the flowers are in oblong spikes. It is imported from Persia.

H. parviflora, *Benth.*, is a native of the temperate Himalaya.

Chemical composition.—Besides tannin, resin, fat, sugar, mucilage, &c., the most important constituent of Hyssop is *oil of hyssop*, of which the fresh herb yields $\frac{1}{4}$ to $\frac{1}{2}$ per cent. It is pale-yellow or greenish, limpid, of about the specific gravity 0·94, and freely soluble in alcohol; it contains oxygen, and commences to boil at 142° C., the boiling-point rising to 180° C. It has the odour and taste of the herb. The *hyssopin* of Herberger (1829) was found by Trommsdorff to be impure sulphate of calcium.

* Sibthorp states that *Satureæa grica*, Linn., is the ὕσσαπο of the modern Greeks, and the زوفى of the Turks. In Sind *Nepeta ciliaris*, Benth., is called Zufah.

Badranjboya, Baklat-el-Utrujiya (*Arab.*). Imported from Persia.

Description.—Calyx striated, hairy, 5-fid, not so long as that of Zúfah-i-yábis, and not coloured; seeds four, naked, brown, 3-angled, nearly smooth, a white patch on each side of the hilum; flowers in axillary clusters of about 6, upon a short peduncle; leaves ovate, margin deeply dentate, somewhat hairy. The drug is always much broken and consists chiefly of stem and fruit; the former is quadrangular, much larger than that of Zúfah, of a purplish tint. Taste bitter, odour faintly aromatic. This herb is supposed to represent the μελισσόφυλλον of Dioscorides and Theophrastus, generally known in Latin as Apiastrum. Virgil (G. 4, 63) calls it Melisphylla, and Theophrastus (4, 25) ἐνώδης μελίττεια. It is a plant beloved by bees, the Balm Gentle or *Melissa officinalis* of our gardens. When fresh it has a pleasant lemon odour, which is not retained by the dry plant. It was formerly valued as a corroborant in hypochondriacal affections, and the Persian drug is still used for this purpose by Indian *hakims*. In Europe, Balm tea is still a domestic remedy, and is given as a grateful diluent in febrile affections: it has a place in the French Codex. The different species of Melissa are widely diffused, being found in Europe, Central Asia, and North America.

Chemical composition.—The leaves of *M. officinalis* contain, besides the common constituents of plants, a small quantity of tannin and bitter principle, and about $\frac{1}{8}$ to $\frac{1}{4}$ per cent. of volatile oil, which is colourless or yellowish, has a specific gravity of about 0·89; dissolves in about 5 parts of alcohol, sp. gr. 0·85, and contains a stearopten.

MARRUBIUM VULGARE, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 1224, *f.* 1; *Eng. Bot.*, 410; *Bentl. and Trim.*, 210. Common White Horehound (*Eng.*), Marrube blanc (*Fr.*).

Hab.—Western Temperate Himalaya to Europe. The herb.

Vernacular.— Farásiyún (*Ind. Bazars*).

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History, Uses, &c.—This plant is the πράσιον of Theophrastus (vi., 2), who mentions two kinds. Dioscorides (iii., 110) relates its medicinal uses, which are also noticed by Hippocrates (681, 3), Celsus (v., 11), and Pliny (20, 89). The ancients considered it to be a general stimulant, expectorant, deobstruent, carminative and local anodyne. Horehound has still a considerable reputation in Europe as a remedy for chronic bronchitis with copious expectoration, and as a stomachic tonic in dyspepsia. It was also formerly prescribed in chronic rheumatism, hepatic and uterine obstructions and ague, the usual dose being from ½ to 1 drachm of the dried herb. The ancients used the expressed juice with honey, both internally and as a local application to foul ulcers and diseased mucous surfaces.

Horehound is the Farásiyún of Ibn Sina and other Arabian physicians, who reproduce the account given by Dioscorides of its medicinal uses. Hakim Ali Giláni, in his commentary upon the Kánun, gives Súf-el-ard, "earth wool," and Hashishat-el-kalb, "dogs' herb," as Arabic names for the plant; he says that dogs always piss on smelling it.

Owing to the similarity between the Greek words πράσιον and πράσον some Mahometan physicians have fallen into the error of supposing the drug to be an alliaceous plant. Hakim Muatamid-el-muluk Syud Alvikhán points out this error, but falls into another, inasmuch as he identifies it with Arusa (*Adhatoda Vasica*). Mahometan writers also mention a second kind of Farásiyún called *Balúti*; this is our Black Horehound (*Ballota nigra*, Linn.).

M. vulgare is a common plant in Persia; Aitchison observed it growing abundantly in Khorasan. In the bazars of the plains of India it is not obtainable; if demanded, either Arusa, or a kind of squill called Farásiyún-i-piyázi, is supplied.

Description.—The branching stem is about a foot high, quadrangular, much-branched, and covered with a white felt. The leaves are opposite, petiolate, about an inch long, roundish-ovate, somewhat heart-shaped or rounded at the base, obtuse, serrate or coarsely crenate, wrinkled by the prominent veins

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below, pale-green and downy above and hoary beneath. The flowers are in dense axillary whorls, with woolly, linear, and hooked bracts, a tubular ten-ribbed calyx divided into ten short, spreading, stiff, and hooked teeth, and a white bilabiate corolla enclosing four stamens. The four achenes are dark-brown.

The herb has a peculiar aromatic and somewhat musky odour and a pungent bitter taste; if kept for any time, the aroma disappears.

Chemical composition.--The plant has been recently examined by J. W. Morrison (*Am. Journ. Pharm.*, 1890, p. 327). A proximate analysis gave the following result:—

	Per cent.
Fat, wax and traces of volatile oil	2·05
Crystalline compound, soluble in ether	·48
Chlorophyl and fat	2·29
Resin and bitter compounds, soluble in absolute alcohol	1·94
Mucilage	4·94
Glucose	·67
Extractive, soluble in water	5·93
Albuminoids	4·48
Pectin and undetermined	5·93
Pararabin	2·30
Cellulose and lignin	37·48
Moisture	6·72
Ash	24 30
Loss	·49

The fat was soluble in hot 95 per cent. alcohol, and melted at 46° C. The wax was insoluble in this solvent, but dissolved in carbon bisulphide. The crystalline principle was extracted from the drug with stronger ether, and purified by repeated crystallization from hot 95 per cent. alcohol, with one or more treatments with animal charcoal. The crystals were insoluble

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in water and in solution of potassium hydrate, very sparingly soluble in boiling water and in cold alcohol. Soluble in hot 95 per cent. alcohol, also in ether and chloroform. They melted at 152° to 153° C. They were at first tasteless, but developed, when held on the tongue, a decided bitterness. The alcoholic solution was very bitter.

Sulphuric or nitric acid gave a dark-brown colour, hydrochloric acid produced no change and ferric chloride produced no change.

This principle reduced Fehling's solution slightly by boiling, without first being treated with an acid. On boiling it first with acidulated water a peculiar aromatic odour was developed, then on heating with Fehling's solution an abundant precipitate of cuprous oxide was produced, thus showing it to be an easily decomposable glucoside.

A small quantity of a bitter principle was extracted from the drug by absolute alcohol, along with the resin. This appeared to be different from the previous one extracted by ether, and for the purpose of further investigation, a larger quantity of the drug was exhausted with ether, the solvent recovered and the residue treated with petroleum ether to remove fat and wax. The remaining portion was dissolved in hot alcohol, treated with animal charcoal and crystallized. The crystals were purified by repeated crystallization and treatment with animal charcoal. Melting point, 152° to 153° C.

The average of two combustions was:—

	Found.	Calculated for. ($C^{40}H^{55}O^{9}$)
C	70·25	70·38
H	8·42	8·50
O	21·33	21·12
	100·00	100·00

Three samples of crystals, presented with a thesis of last year by Frederick G. Hertel, Ph.G. (*American Journal of Pharmacy*, 1890, p. 273), and obtained by him from the fluid extract, were

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also examined. One of these, which he had crystallized from cold alcohol, melted at 153·5° to 154·5° C., was evidently nearly pure ; the average of three combustions gave :—

C	70·54
H	9·08
O	20·38
	100·00

The other samples were evidently the same compound in an impurer condition, as was found by combustion and melting point. The author here remarks :—

"This compound as well as that obtained by myself is evidently the marrubiin discovered by Mein in 1855. Harm (*Archiv der Pharmacie*, No. 83, p. 144) stated the melting point to be 148°C.

"In a later communication (No. 116, page 41), on elementary analysis he found the substance to contain 8·52 per cent. of hydrogen and more than 69 per cent. of carbon.

" Kromayer (*Archiv der Pharmacie*, No. 108, p. 257) gives the yield of marrubiin as about 2 grams from 25 pounds of the drug, and states the melting point to be about 160°C., and that it is not a glucoside. My results indicate its composition to be very close to that of absinthiin, $C^{40}H^{56}O^{9}$, but they do not agree with all the properties of that substance as described by Kromayer in the same journal (No. 108, p. 20), who states that absinthiin melts at 120°to 125° C. Many of the properties, however, are common to both substances, prominent among which are,—solubility, taste, grittiness between the teeth, crystalline appearance and percentage composition."

The larger portion of the drug, after exhaustion with ether, was extracted with methyl alcohol, the solvent recovered, and the residue treated with water and filtered.

The filtrate, on agitation successively with ether and chloroform, yielded to the former a very bitter greenish substance

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with a narcotic odour, and to the latter a brownish substance with a bitter and pungent taste. Both gave negative results when tested for alkaloids and both reduced Fehling's solution, especially after heating with dilute acid, during which process each developed a peculiar aromatic odour. These results point to the presence of two bitter principles besides marrubiin, which is in agreement with Hertel's statement, that after the separation of marrubiin the fluid extract appeared to be as bitter as before.

Anisomeles malabarica, *Br. Bot. Mag., t.* 2071; *Wight Ic., t.* 164, is well known in Southern India, where it is called Peyameratti in Tamil and Mogbira in Telugu. Rumphius, speaking of the juice of the plant, says:—"Idem quoque succus cum binis guttis olei sesamini propinatus, prodest mirifice asthmaticis, vel tussi mala laborantibus, quem in finem syrupus quoque præparatur ex foliorum succo cum saccharo cocto." (*Hort. Amb. v.*, 8, 65.) It is a native of Malabar, where it is called Karintoomba, and is noticed by Rheede. (*Hort. Mal. x.*, p. 185, *t.* 93.) Wight, Ainslie, and others mention that an infusion of the leaves is given to children in colic, dyspepsia, and fever arising from teething; in ague an infusion of the leaves is used to promote perspiration; a decoction of the plant, or the essential oil distilled from it, is used externally in rheumatism. The plant appears to have medicinal properties very similar to those of Horehound.

Description.—Shrubby, 2 to 5 feet; branches obtuse angled; leaves ovate-lanceolate, crenately serrated at the upper part, entire below, about 5 inches long, and 1½ inch broad; calyx 5-cleft, thickly covered with long white rather viscid pubescence; upper lip of corolla entire, white, under one 3-cleft with the lateral divisions reflexed; anthers deep purple; whorls disposed in simple racemes.

LEUCAS ASPERA, *Spreng.*

Fig.—*Rheede, Hort. Mal. x., t.* 91.

Hab.—Plains of India. The herb.

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LEUCAS LINIFOLIA, *Spreng.*

Fig.—*Jacq. Ic. Pl. Rar. i.,* 11, *t.* 111; *Rumph. Herb. Amb. vi., t.* 16, *f.* 1.

Hab.—Plains of India. The herb.

LEUCAS ZEYLANICA, *Br.*

Fig.—*Wight Ill., t.* 176. Herbe Tombée (*Fr.*).

Hab.—Assam to Ceylon. The herb.

LEUCAS CEPHALOTES, *Spreng.*

Fig.—*Wight Ic., t.* 337; *Desf. in Mem. Mus. xi.,* 8, *t.* 4.

Hab.—Himalaya. Plains of N. India and Deccan. The herb.

Vernacular.—Túmba-phúl, Kúmbha-phúl, Bahúphúli (*Mar.*), Goma, Madha-páti (*Hind.*), Tigadi (*Can.*), Kúbo, Kúlán-nú-phúl (*Guz.*), Tumba (*Mal.*), Gul-dora, Chatra (*Punj.*), Halkasa (*Beng.*), Tumi (*Tel.*).

History, Uses, &c.—At least four species of Leucas are used in Hindu medicine under the Sanskrit name of *Drona-pushpi* or "cup-flower," so called from the resemblance of the calyx of these plants to a little cup. The synonyms for these plants are *Kumbha-yoni, Kurumba, Kharva-yattra, Chitra-pattrika, Chitrákshupa* and *Su-pushpa;* they are described in the Nighantas as heavy, dry, sweet, hot, and aperient, generators of wind and bile, and are prescribed for jaundice and to expel phlegmatic humors and worms; they are also considered to be stimulant and diaphoretic.

In the cough or catarrh of children, *Tumba* juice 1 part, with 2 parts of honey and a few grains of Borax, may be mixed, and a few drops given occasionally, and in intestinal catarrh 6 drops of the juice may be given with a little powdered *Khárik* (dry dates).

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These plants are also used in Hindu ritual; during the ceremonial bath, early in the morning on the *Naraka Chaturdasi*, or first day of the *Divali*, the religious manuals direct the whirling round the body, while bathing, of a sprig of *Drona-pushpi* of *Achyranthes aspera* (*apámárga*), and of *Cassia Tora* (*prapunáta*), cf. Vol. II., p. 65. The Mahometan physicians have given these plants the name of *Sisáliyús*, and use them as a substitute for the true *Sisáliyús* (*Myrrhis odorata*), as stimulant diaphoretics. Rheede notices the use of *L. aspera* in Malabar, and the same species is given in amenorrhœa at Réunion. Under the name of *Herba admirationis* a species of Leucas, probably *L. linifolia*, is described by Rumphius. In Western India *L. zeylanica* is much used, and in the Punjab *L. cephalotes*. These plants are a popular local application to itch and mange, and the juice of the leaves snuffed up by the nostrils is used as a remedy in snakebites, and for headáche and colds. An infusion is known as an insecticide, and planters and others on the Nilgiris find that blight and insect pests may be kept away from trees by a diligent application of this remedy. The flowers are offered in the Hindu temples. In Réunion *L. zeylanica* is known as *Herbe Tombée*, and is considered to be stimulant and antirheumatic.

Description.—*L. aspera* is annual, erect or diffuse, stem stout, hispid or scabrid, leaves 1 to 3 inches, linear or oblong obtuse, entire or crenate, whorls large, terminal and axillary, bracts long, linear and filiform, calyx $\frac{1}{4}$ to $\frac{3}{8}$ of an inch, tubular, curved, smooth below, green and ribbed and scabrid above, contracted above the nutlets, mouth small, glabrous, very oblique, shortly and irregularly toothed, flowers small, white. *L. linifolia* and *L. zeylanica* are very similar plants, and *L. cephalotes* has very large terminal and globose whorls of flowers. These plants have an odour recalling that of the Dead-nettle (*Lamium album*), but *L. aspera* is more fragrant than the others.

Chemical composition.—The herb of *L. zeylanica* on distillation afforded a very small quantity of essential oil. By boiling a decoction of the herb with soda solution a strong odour was

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given off, and on condensing the vapour, ammonia and a volatile alkaloid were detected in the distillate. The alkaloid was combined in the plant with an acid giving a green colour with ferric salts. The air-dried plant afforded 7·3 per cent. of ash.

Leonotis nepetæfolia, *Br. Bot. Reg.*, *t.* 281; *WightIc.*, *t.* 867; *Vern.*—Hejur-chei (*Beng.*), Mátijer, Mátisúl (*Guz.*), Dípmal (*Mar.*), is a large and conspicuous annual common in the neighbourhood of villages throughout the hotter parts of India. It is easily recognised by its globular spinous heads of orange-coloured flowers. Roxburgh gives the following description of the plant:—"Stem annual, straight, four-sided, simple, from 4 to 6 feet high. Leaves opposite, spreading, petioled, cordate, serrate, pointed, downy, from 4 to 8 inches long, and 2 to 3 broad. Floral leaves (*bractes verticillorum*) lanceolate, depending. Petioles channelled, winged with the decurrent leaf; verticels globular, 2, 3 or 4, towards the apex of the plant about 5 inches asunder. Involucres many, subulate. Flowers numerous, of a deep rich orange colour. Calyx, 10-striated, 8-toothed; corol, under lip very short, 3-toothed, at all times of a dirty withered colour."

The ashes of the flower-heads mixed with curds are applied to ringworm and other itchy diseases of the skin. Dr. A. J. Amadeo states that it is called *Rascamoño* in Porto-Rico, and that a decoction of the leaves is used as a tonic, the juice is also expressed and taken with limejuice and rum as a febrifuge. Dr. Amadeo has used it in combination with *Phyllanthus Niruri* in intermittents.

Buliun (πολίον), the Poly-Germander (*Teucrium Polium*, L.), **Iskurdiyun** (σκορδίον), the Water-Germander (*T. Scordium*), and **Kamazariyus** (χαμαίδρυς), the Wall-Germander (*T. Chamædrys*), are treated of in the Materia Medica of the Indian Mahometan physicians, but none of these plants are, as far as our experience goes, obtainable in the bazars, although *T. Scordium* is a native of the Western Himalaya and Cashmere. This plant has an odour of garlic, and is one of the ingredients in the

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Tiryák-i-Farúk or *Theriaca Andromachi*, which is still sold in the bazars of India. *T. Polium* is a native of Persia, and was found by Aitchison in Khorasan, but he did not observe that it was used medicinally. He also notices *T. serratum*, Benth., as having a strong odour of asafœtida. *T. Chamædrys* was formerly used in Europe as a remedy for gout, and was an ingredient in the celebrated antiarthritic or Portland powder.

PLANTAGINEÆ.

PLANTAGO OVATA, *Forsk.*

Fig.—*Bentl. and Trim.*, *t.* 211. Syn. *P. Ispaghula.*

Hab.—Punjab, Sind, Persia. The seeds. Spogel seeds (*Eng.*).

Vernacular.—Isbaghol (*Hind.*), Esabgol (*Mar.*), Eshopghol (*Beng.*), Esopgol, Uthamu-jirun (*Guz.*), Ishappukol-virai (*Tam.*), Isapagála-vittulu (*Tel.*), Isabakolu (*Can.*).

History, Uses, &c.—The seeds are not mentioned by the old Hindu writers, but the Guzerathi name appears to be of Sanskrit origin. In all the vernaculars corruptions of the Persian name *Ispaghúl* are in use. This word is a compound of اسپ "a horse," and غول "the ear," in allusion to the shape of the seeds. In Mahometan works the seeds will be found described under the name of *Bazr-i-Katúna*. The author of the *Makhzan* states that *Kalíún* is the Greek, *Isparzah* the Isfaháni, and *Bangúst* and *Shikam-daridah* the Shirazi names for them. In India, they are considered to be cooling and demulcent, and useful in inflammatory and bilious derangements of the digestive organs. The crushed seeds made into a poultice with vinegar and oil are applied to rheumatic and gouty swellings. With the mucilage a cooling lotion for the head is made. Two to three dirhems moistened with hot water and mixed with sugar are given in dysentery and irritation of the intestinal

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canal to procure an easy stool. The decoction is prescribed in cough. The roasted seeds have an astringent effect, and are useful in irritation of the bowels in children, and in dysentery. The natives have an idea that the powdered seeds are injurious, and consequently always administer them whole. Fleming, Twining, Ainslie, and others speak very favourably of the use of *Ispaghúl* in the treatment of chronic diarrhœa. Twining gives the dose for an adult as 2½ drachms mixed with half a drachm of sugar-candy. (*Diseases of Bengal*, Vol. I., p. 212.) In the *Pharmacopœia of India* the seeds have been made official, and directions are given for the preparation of a decoction.

Description.—The seeds are boat-shaped, about ⅛ of an inch long and rather less than $\frac{1}{16}$ broad, translucent, with a pinkish tinge and a faint brown streak upon the convex side. The concavity is covered with a thin white membrane. Soaked in water they become coated with an abundant adherent mucilage which is free from taste and odour. The epidermis of the seeds is composed of polyhedral cells, the walls of which are thickened by secondary deposits, the source of the mucilage; between it and the albumen is a thin brownish layer. The albumen is formed of thick walled cells which contain granular matter.

P. amplexicaulis, *Cav. Ic. ii., t.* 125, a plant of the Punjab Plains, Malwa and Sind, extending to Southern Europe, furnishes the brown *Ispaghúl* not unfrequently to be met with in the Indian bazars. The seeds have the same boat-shaped form as those of *P. ovata*, but are rather larger, averaging ⅙ of an inch in length. They are probably as efficient as the true Ispaghúl seeds.

Commerce.—Large quantities of these seeds are imported into Bombay from Persia. Value, Rs. 4 per maund of 37½ lbs.

They differ in colour, some being brown and some nearly white with a pinkish tinge; the latter are preferred.

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PLANTAGO MAJOR, *Linn.*

Fig.—*Wight Ill.*, *t.* 177; *Eng. Bot.*, 1558. Greater Plantain (*Eng.*), Grand Plantain (*Fr.*).

Hab.—Temperate India, Persia, Europe. The seeds.

Vernacular.—Bártang, Bárhang (*Indian bazars*).

History, Uses, &c.—Under the name of αρνογλωσσον Dioscorides describes two varieties of Plantago, the greater and the lesser, and states that the first is the best and most generally used. These plants were known to the Romans as Plantago, and according to Sibthorp are the *P. lagopus* and *P. altissima* of modern botany; they were considered to be very effectual in arresting the fluxes known by the Greeks as "rheumatismi," or "griping pains in the bowels" (*Plin.* 25, 39; 26, 47). The leaves and roots were considered to be astringent and febrifuge (*Galen*). The Arabian physicians describe them under the name of Lisán-el-hamal, and state that they are the Sabaat-azlaa and Kasrat-el-azlaa of Dioscorides (Arabic translations of ἑπτάπλευρον, and πολύνευρον) meaning '*seven-ribbed and many-ribbed*'; they repeat what the Greeks have written with a few trifling additions. The seeds of *P. major* are largely imported into India from Persia, and have a great reputation as a remedy for dysentery. Valentine Baker states that he was cured by these seeds when suffering from the disease during his travels in Khorasan. The root and leaves are still in use in Europe as domestic remedies on account of their mucilaginous properties.

The seeds of **P. Psyllium**, *Linn.*, a native of the N. W. Punjab, extending to Southern Europe, are used in a similar manner. This plant is often stated to be the source of the Persian Bárhang, but we have always obtained *P. major* by sowing these seeds.

Description.—The seeds are minute, oblong and brown, marked with waved, slightly elevated, longitudinal ridges of a darker colour; one side is arched, the other concave and marked

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with a scar showing the attachment to the ovary. They are insipid, and have an oily smell when crushed. Soaked in water they become coated with a transparent mucilage.

Chemical composition.—The leaves of *P. major* have been examined chemically by Dr. Rosenbaum, but the results obtained do not indicate any active principle. He found that petroleum benzine extracted 4 per cent. of wax and chlorophyll, the extract fusing at 83° C. Ether dissolved 4·4 per cent. of resin and chlorophyll. Alcohol extracted 10 per cent., of which 6 per cent. was soluble in water and contained a considerable amount of sugar; the remaining four parts were soluble in ammonia. Water took up 13 per cent., of which 7·2 per cent. was insoluble in 66 per cent. alcohol. Soda solution dissolved 6 per cent., and diluted acid 10 per cent., the latter containing a notable quantity of calcium oxalate. It may be noted here that Th. Koller, in 1868, found citric acid and oxalic acid in the three species, *P. major*, *P. lanceolata*, and *P. media*, besides the ordinary plant constituents, chlorophyll, resin, wax, albumen, and pectin. These constituents do not account for the reputation as a styptic and vulnerary in which the plant was held by ancient writers. The presence of sugar indicates the possibility of a glucoside being contained in the plant. The value of the seeds in diarrhœa and dysentery is no doubt due in some measure to the quantity of mucilage they afford. (*Amer. Journ. Pharm.*, Sept., 1886.)

Plantago mucilage is neutral in reaction, is not altered by iodine or precipitated by borax, alcohol, or perchloride of iron. It is only sparingly soluble in water. R. W. Bauer separated the carbohydrate *xylose* (previously obtained from wood-gum) from the epidermis of *P. Psyllium*, by boiling the aqueous extract with dilute sulphuric acid. It was identified by its melting point, rotatory power, and by its compound with phenylhydrazine. Wood-gum can be obtained from beech wood, jute, or deal, by extracting with 5 per cent. soda and precipitating with alcohol and HCl. When this is hydrolysed, it yields Koch's wood-sugar or xylose. Xylose closely resembles arabinose in all its properties, and, like the

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latter, is dextrorotatory; when treated with acids, it yields considerable quantities of furfuramide, but no levulose. The phenylosazone has the composition $C^{17}H^{20}N^{4}O^{3}$, so that xylose is a penta-glucose $C^{5}H^{10}O^{5}$. When treated with nitric acid, it is converted into acids containing 4 or 5 atoms of carbon. Xylose and arabinose, and all substances from which they can be obtained, give the cherry-red coloration of arabin when warmed with phloroglucinol and hydrochloric acid. This reaction can be employed for the detection of xylose and arabinose. (*Journ. Chem. Soc.*, LVI., pp. 233, 847.)

NYCTAGINEÆ.

BOERHAAVIA REPENS, *Linn.*

Fig.—*Delile, Fl. Eg., t.* 3, *f.* 1; *Wight Ic., t.* 874; *Rheede, Hort. Mal. vii., t.* 56. Spreading Hogweed (*Eng.*), Patagon (*Fr.*).

Hab.—Throughout India. The herb and root.

Vernacular.—Sánt, Thikrí (*Hind.*), Purna, Punarnaba (*Beng.*), Khápra, Punanava, Kálivasu, Ghetulí (*Mar.*), Múkku-rattai (*Tam.*), Atíka-mámidi (*Tel.*), Vakha-khaparo, Sátodí-mula (*Guz.*), Ganajali, Biléganjali (*Can.*).

History, Uses, &c.—This plant is called by Sanskrit medical writers Punar-nava, Punar-bhava, and Punar-bhu, on account of its perennial habit, and Sothagni from its use as a remedy for dropsy. It is described in the Nighantas as pungent, dry, hot, sweet and bitter, and is recommended as a laxative, diuretic, and stomachic in jaundice, strangury, dropsy, and internal inflammations. A compound decoction, *Punarnavashtaka*, is made of the roots, dried Neem bark, leaves of *Trichosanthes dioica*, dried ginger, root of *Picrorhiza Kurrooa*, chebulic myrobalans, stem of *Tinospora cordifolia*, and dried wood of *Berberis* (Dárhalad), each one quarter tola, water 32 tolas, boiled

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down to one-fourth, which is to be taken during the 24 hours. An oil and electuary are also used.

Ainslie mentions the use of the root in powder, in the quantity of a teaspoonful twice daily, as a laxative. In the *Pharmacopœia of India* its successful use as an expectorant in asthma is noticed, and it is said to act as an emetic when given in large doses. This has been confirmed by the experience of the French in the Antilles, where the plant is called *Patagon* or *Patagonelle-Valeriane*. In Western India the herb is used as a diuretic in gonorrhœa, and as an external application the pounded leaves are applied to dropsical swellings. In the rainy season, when luxuriant, it is eaten as a potherb, after having been well boiled to remove its medicinal properties. The use of the root in gonorrhœa appears to have been introduced by the Portuguese; in the West Indies the plant is known as *Bejuco de purgacion*, and is the popular remedy for that disease. A decoction (1 oz. to a pint of water) is used in doses of a wineglassful every hour.

Description.—A common creeping weed on waste ground and roadsides; stalks numerous, about two feet long, slender, procumbent; leaves cordate-ovate, unequal, opposite, edges waved, tinged with red; flowers small, sessile on the apex of the pedicels, peduncles from the axils and ends of the branches; fruit oblong, dull green, or brownish, viscid, about the size of a caraway, longitudinally 5-grooved, studded all over with glandular hairs; root twisted, often as thick as the finger when fresh, whitish, fleshy, 2 to 3-branched, a foot long or more; taste bitterish, nauseous. A microscopic section shows that the parenchyme is loaded with needle-shaped crystals, otherwise there is nothing peculiar.

There are two varieties of the plant, one with white and the other with red flowers; in Bengal the former is called Svetapurna and the latter Gudha-purna.

Chemical composition.—The whole plant was used for the examination, and, with the exception of minute traces of a principle soluble in ether, and affording reactions with

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alkaloidal reagents, nothing of interest was detected. No principle reacting with ferric salts was present.

MIRABILIS JALAPA, *Linn.*

Fig.—*Bot. Mag., t.* 371 ; *Rheede, Hort. Mal.x., t.* 75. Marvel of Peru (*Eng.*), Belle de nuit (*Fr.*).

Hab.—West Indies. Cultivated in India. The leaves and root.

Vernacular.—Gul A'bbás (*Pers., Ind.*), Krishna-keli (*Beng.*), Anthinarlu, Patharachi (*Tam.*), Batharachi (*Tel.*), Madhyánhamallige (*Can.*), Antimalari (*Mal.*), Gulbás, Gulbas (*Mar.*).

History, Uses, &c.—Five varieties of this plant, with red, white, yellow, red and white, and red and yellow flowers, were introduced from the West Indies in 1596, and must have been carried by the Portuguese to the East shortly afterwards, as the plant is said to have been introduced into Persia in the reign of Shah Abbas the first, and was established on the Malabar Coast in the time of Van Rheede. It was at one time supposed to produce the Jalap of commerce. *M. Jalapa* has been given the Sanskrit name of Sandhyakali, or "evening flower," but is best known by its Persian name of Gul A'bbas, or "flower of A'bbás"; it is a favorite flower of the Persians, who cultivate it in ornamental flower pots. The Arabs call it Shab-el-leili, which is evidently a translation of the French "belle de nuit"; it is the *Fula quadrohoras*, or "four o'clock flower," of the Portuguese, as its flowers open at that hour in the afternoon.

In India the leaves boiled in water are applied as a maturant to boils and buboes, and the juice, which is considered to be very cooling, is applied to the body to allay the heat and itching in the urticaria arising from dyspepsia; the *U. febrilis* or *U. ab ingestis* of European physicians, which the Hindus consider to be caused by bile in the blood. The seeds are said to be sometimes used to adulterate black pepper. The root is said to be a mild purgative,

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but Loureiro remarks, "Hæc radix non est apta ad medicinam, nisi per aliquot annos in viva planta senescat; tuncque sit subrotunda, rugosa, exterius subnigra, intus fusco-pallida, circulis concentricis nigricantibus distincta." In the Concan the dried root powdered, and fried in *ghi* with spices, is given with milk as a *paushtik* or strengthening medicine, and rubbed down with water to a paste it is applied to contusions.

Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*, Oct. 1889) states that in Tanjore the roots boiled and made into curry are considered beneficial to those who suffer from piles, and that a powder and confection are also in use. The powder contains five drachms of root, two and a half each of long and black pepper, and five ounces of sugar. Dose ʒi, twice daily. The confection has the same quantity of root with 2½ drachms each of nutmeg, mace, and Atis root, *ghi* 1 oz., sugar and milk of each 10 ounces. Dose as above.

Dr. Mootooswamy finds the root to act as an astringent in these preparations. Ainslie, quoting Fleming (*Cat.*, p. 29), states that the root was tried as a purgative by Drs. Hunter and Shoolbred, but found to have so feeble a purgative action as to be useless. He also tried it himself with the same result. According to Thunberg, the Japanese prepare a kind of white paint for their complexions from the seeds.

Description.—The root of young plants is cylindrical above and tapering below, but in old plants it becomes napiform or subrotund, the external surface is dark brown and marked with numerous circular rings; internally it is dirty white or greyish. When dry, very old roots become hard, compact and heavy, and deepen in colour, but younger roots are of a leathery consistence. It has a faintly nauseous odour, and a sweetish, subacrid taste. A transverse section of the root shows numerous concentric rings of a darker colour than the intervening substance; it shows numerous acicular crystals when magnified.

Chemical composition.—The roots were collected in July, cut into slices, and exposed to warm air, then reduced to powder and the desiccation completed at 100° C.

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The fresh roots dried over sulphuric acid lost 81·136 per cent. in weight; the ash amounted to 6·135 per cent., and was free from manganese.

The proximate analysis was made with the powdered roots dried at 100° C., and was conducted according to Dragendorff's plan with the following results:—

Light petroleum ether extract		0·580 per cent.
Ether extract, soluble in water	0·09 per cent.	
alcohol	0·222 "	
Residue insoluble in water or alcohol	0·028 "	0·340 "
Absolute alcohol extract		3·040 "
Aqueous extract containing glucose 1·6 per cent., saccharose or allied carbohydrate 7·97 per cent.		30·62 "

The petroleum ether extractive was soft and pale yellowish in colour, non-crystalline, and without any special odour. It consisted of wax, and a pale yellow oil, soluble in absolute alcohol with neutral reaction.

The ethereal extract was soft and yellowish. The portion soluble in water had an acid reaction, but gave no coloration with ferric chloride. Acidulated with sulphuric acid a slight precipitate was afforded with Mayer's reagent. The residue of the ethereal extract soluble in alcohol was also yellowish, soft' and on standing became indistinctly crystalline. Treated with water acidulated with sulphuric acid it gave no alkaloidal reactions; with alkalies on gently warming it was slightly soluble, with pale yellow coloration: the colour being destroyed by acids, and whitish flocks precipitated.

The alcoholic tincture of the roots was of a port-wine colour, and the extract of a deep orange tint. In water part was soluble with acid reaction, and afforded a precipitate with alkaloidal reagents. The extract was treated with ammonia, in which the greater part dissolved, affording a dirty brownish-red solution, and the solution agitated with ether: the ethereal extract

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amounted to 0·384 per cent. and contained a small amount of alkaloid with much colouring matter. An attempt was made to purify the alkaloid by reagitating this extract from an acid solution with ether, and then neutralizing and again agitating with ether; an unweighable amount of the alkaloid was, however, obtained. No special colour reactions of the alkaloid were noted. An alkaline solution of the alcoholic extract was only slightly precipitated by acids, the solution remaining dark-coloured. The aqueous extract contained 1·6 per cent. of glucose calculated on the roots dried at 100°C. After boiling with dilute sulphuric acid a second determination with Fehling's solution was made, and the result calculated as saccharose, which was equivalent to 7·97 per cent.

In order to determine whether the plant had any injurious properties, the alcoholic extract from 10 grams of the dried and pounded roots was mixed with a few drops of ammonia and water and injected into a cat's stomach; the cat vomited once, but was not otherwise inconvenienced.

AMARANTACEÆ.

ACHYRANTHES ASPERA, *Linn.*

Fig.—*Wight Ic., t.* 1780. Prickly Chaff-flower (*Eng.*).

Hab.—Throughout India and tropical Asia. The herb.

Vernacular.—Unga, Latchira, Chirchira (*Hind.*), Apang (*Beng.*)., Pándhara-ághada, Ághada (*Mar.*), Sufed-ághado (*Guz.*), Na-yurivi (*Tam.*), Uttareni, Antisha (*Tel.*), Uttaráni, Uttaréni (*Can.*), Kataláti (*Mal.*).

History, Uses, &c.—This plant has given a name to the sacrificial offering called *Apamarga Homa,* which consisted of a handful of the flour of the seeds offered at daybreak, but which is not now, as far as we know, practised in India. According to the Black Yajurveda, Indra, having killed Vritra and other demons, was overcome by Namuchi and made peace with him, promising never to kill him with any solid or liquid, neither by day nor by night. But Indra collected some foam, which is

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neither solid nor liquid, and killed Namuchi in the morning between night and daybreak. From the head of the demon sprung the herb Apamarga, with the assistance of which Indra was able to kill all demons. Hence this plant has the reputation of being a powerful talisman, and is now popularly supposed to act as a safeguard against scorpions and snakes by paralysing them.* It is waved round the body whilst taking the ceremonial bath early in the morning on the Naraka Chaturdasi or first day of the Diváli (new year) festival.

The Sanskrit synonyms for the plant are Shikhari, Kini or Kinihi, Khara-manjari "having a rough flower-stalk," Adhva-shalya "roadside rice," Shaikharika, Pratyak-pushpi "having reverted flowers," and Mayuraka "crested." It is described in the Nighantas as purgative, pungent, digestive; a remedy for phlegm, wind, inflammation of the internal organs, piles, itch, abdominal enlargements, and enlarged cervical glands. The ashes are used by the Hindus in preparing caustic alkaline preparations. The diuretic properties of the plant are well known to the natives of India, and European physicians agree as to its value in dropsical affections; one ounce of the plant may be boiled in ten ounces of water for 15 minutes, and from 1 to 2 ounces of the decoction be given 3 times a day. (*Pharm. of India*, p. 184.)

Different parts of the plant are ingredients in many native prescriptions in combination with more active remedies.

In Western India the juice is applied to relieve toothache. The ashes with honey are given to relieve cough; the root in doses of one tolá is given at bedtime for night blindness, and rubbed into a paste with water it is used as an *anjan* (eye salve) in opacities of the cornea. The seeds are often used as a famine food in India, especially in Rájputana, where the plant is called Bharotha, भरोटा (grass).

Description.—A common weed, with an erect, striated pubescent stem, generally about two feet high, but sometimes much more. Side branches in pairs, spreading; leaves pubescent

* Compare with Scribonius Comp. 163, 164, where similar superstitions are recorded.

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from the presence of a thick coat of long simple hairs, obovate, undulated, very obtuse, acuminated, base attenuated; petiole short; spikes long, lax; flowers green; bracts rigid, prickly. Sections of the stem do not show any crystalline deposit in the parenchyma. The seeds are oblong, of a brown colour, from $\frac{1}{10}$ to $\frac{1}{8}$ of an inch in length; on one side a grooved prominence is seen which indicates the position of the embryo where it curves round the mealy albumen. The starch granules are very small, and are so closely packed that the large irregular-shaped cells which contain them have almost the appearance of parenchymatous cells.

Chemical composition.—The whole plant collected in August was used. A proximate analysis failed to indicate the presence of any principle of special interest. No alkaloidal body was detected, and the alcoholic extract contained no principle reacting with ferric salts.

For the ash determination, the roots, stems and leaves were separately examined with the following results:—

	Leaves.	Stems.	Roots.
P^2O^5	3·0257	2·6939	1·8594
SiO^2 as Sand ...	39·7192	12·9716	21·4219
SO^3	1·3200	2·6534	3·9523
CaO..........	13·8893	13·1233	12·9335
MgO	3·4778	3·5149	5·4419
K^2O..........	17·8454	32·0008	28·5830
Na^2O	......	......	·9860
Fe^2O^3	2·7931	3·0352	5·6297
Manganese	Traces, not estimated.	Not estimated.	Not estimated.
KCl..........	5·7416	9·5221	......
NaCl	1·1770	1·5261	3·2951
Al^2O^3	2·0651	Not estimated.	Not estimated.
CO^2..........	8·8687	13·6294	11·0057
Carbon	·3297	·5525	Not estimated.
	100·2526	95·2232	95·1085

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The leaves, stems, and roots dried at 100°C. afforded respectively the following percentages of ash :—Leaves, 24·334 ; stems, 8·672 ; roots, 8·863. The large amount of sand present in the ash is due to the fact of the plants having been collected during the rains, and when received they were coated with finely divided silicious matter.

The total potash calculated as K_2O was equivalent in the leaves to 21·4986 per cent., in the stems to 38·0122 per cent., and in the roots to 28·5830 per cent. It is possible that the plant might be of value as a cheap green manure on account of its potash content. (*Warden, Chem. News*, Vol. ii., 1891).

Amarantus spinosus, *Linn., Willd. Amar.* 38, *t.* 4, *f.* 8; *Vern.*—Tanduliya (*Sans.*), Kántemáth (*Bomb.*), Kántanatia (*Beng.*), Mulluk-kirai (*Tam.*), Kántálo-dambho (*Guz.*), possesses mucilaginous properties. The Hindu physicians prescribe the root in combination with other drugs in menorrhagia. It is considered to be a specific for colic. A poultice of the leaves was officinal in the *Bengal Pharmacopœia.*

The authors of the *Pharmacopœia of India* regard the plant as a simple emollient, and inferior to many others, but recently the root has been found to be of great service in the treatment of gonorrhœa and eczema. In gonorrhœa it is said to stop the muco-purulent discharge, and all the concomitant symptoms, such as heat, scalding and general irritation.

ÆRUA JAVANICA, *Juss.*

Fig.—*Wight Ic., t.* 876.

Hab.—Plains of India. The herb.

ÆRUA LANATA, *Juss.*

Fig.—*Wight Ic., t.* 723; *Rheede, Hort. Mal. x., t.* 29.

Hab.—Plains of India. The herb.

Vernacular.—Chaya (*Hind., Beng.*), Bhui-kallán (*Punj.*), Kumra-pindi, Kapur-madhura, Kapur-phuti (*Mar.*), Pindiconda, Kamiupulai, Nilapulai (*Tel.*), Pulai, Sirru-pulai (*Tam.*).

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History, Uses, &c.—These plants are used by the natives of India as diuretics, and are considered to be of great value in lithiasis; they are also thought to be antidotal in cases of poisoning by arsenic. The flowers are sold in the bazars of Northern India under the name of Bhui-kallán. *Æ. lanata* is the Scherubala of Rheede, and Ainslie states that the Vytians consider the root to be demulcent and prescribe a decoction in strangury; in the Concan it is used as a diuretic. *Æ. javanica* has a great reputation in Hyderabad, Deccan, as a remedy for lithiasis, and the flowers have been brought to us for identification by the medical attendant of a gentleman in Bombay, who had been in the habit of obtaining them from Hyderabad under the Marathi name of Kumra-pindi, which is equivalent to the Telingi Pindi-conda, and signifies "cock's *pinda*"; we were informed that much benefit had been derived from their use. These plants resemble *Achyranthes aspera* in their medicinal properties. The flowers are very soft and woolly, and are used for stuffing pillows and mattresses in Sind and in Egypt. In Southern India the natives use the flowering spikes during the Pongul festival for decorating their houses.

Description.—The plants have a white tomentose appearance. The leaves are alternate. The minute flowers are in dense terminal or axillary spikes, those of *Æ. javanica* being much the largest, often 4 to 5 inches in length; they are hermaphrodite, with three concave persistent bracts. The calyx consists of five, nearly equal, erect and hairy sepals; the five stamens are united into a cup at their base; the ovary is one-celled, with a single ovule in each cell. The fruit is a roundish utricle.

CELOSIA ARGENTEA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1767; *Rheede*, *Hort. Mal. x.*, *t.* 38, 39.

Hab.—Throughout India and tropical Asia. The seeds.

Vernacular.—Sarwáli, Suféd-murgha (*Hind.*), Svet-murga (*Beng.*), Lápadi (*Guz.*), Kurdu (*Mar.*), Gurugu (*Tel.*), Goraji (*Can.*)

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History, Uses, &c.—This common annual plant is considered by some to be the Vitunna of Sanskrit writers; when young and tender it is eaten as a vegetable, but is considered to be very heating. The seeds are considered an efficacious remedy in diarrhœa. Indian Mahometan writers on Materia Medica have adopted Sarwáli as a substitute for the βρεταννικη of Dioscorides, and the Herba Britannica of Pliny, which has been identified by Prof. Muntingius of Groningen as *Rumex Hydrolapathum*, Huds., our Water Dock, the Patience aquatique of the French, and Wasserampfer of the Germans. The author of the *Mufferidat-i-Nasiri* states that 180 grains of the seeds, with an equal quantity of sugar-candy, taken daily in a cup of milk, is a most powerful aphrodisiac.

Dr. Watt (*Dict. Econ. Prod. Ind.*, ii, 240) states, on the authority of the Rev. A. Campbell, that the Santals extract a medicinal oil from the seeds.

Description.—Stem 1 to 3 feet, stout or slender, simple or branched; leaves 1 to 6 inches, narrow; spikes solitary, few or many, 1 to 8 by ¾ to 1 inch; peduncle slender; flowers white, tipped with pink, glistening; bracts much shorter than the acute sepals. Seeds lenticular, brown, polished, $\frac{1}{16}$ of an inch in diameter.

Chemical composition.—The following is an analysis of the finely powdered seeds:—

Oil	6·76
Resin, soluble in ether	·81
Alcoholic extract	1·94
Water extract	24·70
Starch, &c.	37·96
Fibre	11·23
Ash	5·80
Moisture	10·80
	100·00

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The alcoholic extract contained an alkaloidal principle precipitable by alkalies, soluble in ether, and giving a rose colour with strong sulphuric acid.

CHENOPODIACEÆ.

USHNAN.

GENERA.—**Arthrocnemum, Caroxylon, Salicornia, Salsola, Suæda.** Soda plants.

History, Uses, &c.—Sarjikákshára has doubtless been prepared in India, as it is at the present time, from a very early date. In the time of Pliny a mineral alkali appears to have been prepared in Egypt from the ashes of certain plants and to have been known as Natrum, or in Greek νίτρον (*Plin.* 31, 10), and Strabo, as cited by Beckman, mentions an alkaline water in Armenia used for washing clothes. (*Hist. of Invent.* iii., p. 233.) The plants from which Barilla was prepared were known to the Greeks as τό ἅλιμον or salt-worts. (*Theophr.* H. P. iv., 20; *Diosc.* i., 105.) The Arabs also were early acquainted with the same substance, which seems to have been sometimes potash, or a mixture of soda and potash in various proportions, and to which they gave the name of القلى El-kali or alkali. The Arabian writers describe Ushnán as good for the mange or scab, and the itch; clearing to the complexion, cleansing, emmenagogue and abortive, and a substance with which clothes and the hands are washed. The author of the *Makhzan*, speaking of Ushnán, states that it is a name applied to several plants, one of which has slender branches instead of leaves, upon which knob-like bodies form (*Suæda fruticosa?*). This plant is always fresh and juicy, and is a large herb with round woody stems. He then describes the manner in which the plant is burned in a pit in the ground, and the Kali or Barilla extracted from the ashes. After this he mentions another plant with reddish stems and leaves purplish on one

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side and green on the other (*Chenopodium atriplicis?*), yielding a juice which stains black; this plant he says is very common in Sind and Múltan, and is used for staining the black pattern on the Sind pottery. Lastly, he mentions a plant called Khurú-el-'asáfir (sparrow's dung) with white leaves (*Chenopodium album?*), and another which is called in Persia Ghásool, and is used for dissolving lac dye, and as a substitute for ink, Dr. Watt, in the *Dictionary of the Economic Products of India*, gives the following list of plants which are used in the manufacture of Sajji-khar or Barilla:—

Arthrocnemum indicum, *Moq.*
Caroxylon fœtidum, *Moq.*
„ **Griffithii**, *Moq.*
Salicornia brachiata, *Roxb.*
Salsola Kali, *Willd.*
Suæda fruticosa, *Forsk.*
„ **indica**, *Moq.*
„ **nudiflora**, *Moq.*

Aitchison states that the name Ishlan (probably a mispronunciation of Ushnán) is applied in the Hari-rud Valley to *Anabasis erispoda*, Benth. et Hook. f., which is used in preparing barilla. In the *Report on Punjab Products*, it is stated that the plants are cut down during the cold months, dried and burnt in a pit of a hemispherical shape, about six feet in circumference and three deep, at the bottom of which one or more inverted earthen pots, having small holes in their bottoms, are sunk. The holes are kept closed at first, but when the alkali begins to run, they are cleared to allow it to fill the pots; when cool it forms a porous mass of a greyish-white colour, consisting of carbonates of soda and potash, sulphate of soda, and organic matter. In native practice this substance is prescribed like our preparations of the caustic alkalies. It is the Sarjikákshára of the Rája Nirghanta and the Sájji of the bazars.

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SHUKAI.

Hab.—Persia. The herb.

Vernacular.—Shukai (*Ind. Bazars*).

History, Uses, &c.—This drug is described in Mahometan works as the Akranîkî* or Afsharnîkî of the Greeks. Other Arabic names given are Shaukat-el-baida, Shaukat-el-Arabiya, and Kathir-el-rakab. Ibn Sina says it is the same as Bázaward (Bádaward, *Pers.*) Muhammad Husain very truly denies this; he says the Persian names are Charchah and Kangarkhár, and describes two varieties, one with a white flower and more slender stems than the other, which has purple flowers, and is the kind generally used. The latter, he says, has triangular stems, the size of a man's finger or less, and thick, small, triangular, downy leaves terminating in thorns; the seeds are small, triangular, and of a greyish colour. The whole drug is of a yellowish white colour and sweetish taste. The plant and fruit are generally used, but the root is to be preferred. Shukai is more drying and astringent than Bádaward; it is attenuant and deobstruent, &c., &c. (*Makhzan-el-Adwiya*, article *Shukai*) Haji Zein-el-Attar states that it is useful in palsy and other diseases caused by cold humors. He quotes Galen as recommending its use in melancholia, and Paulus as saying that it is useful in leprosy. In Persia it is said to have a reputation as a remedy for ague. The dose is from 2 to 5 dirhams.

Description.—The drug as met with in India consists of all parts of the plant broken up, but very little of the root is present. The portions of the stem are of a greenish-yellow colour, round, crooked, channelled, with numerous branches springing from the axils of the leaves; the external surface of the stem is siliceous, hard, and pubescent; internally it is full of soft pith. The petioles of the leaves are stem-clasping, the lower ones completely so. The lower leaves are of considerable

* Possibly from ἀκρώνυχος, on account of its thick leaves, each lobe of which terminates in a thorn.

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size with a triangular midrib, channelled on the upper surface, and short, thick, spinous lobes which vary much in shape. The plant has a gummy, rather disagreeable taste. The fruit is occasionally found mixed with the drug in considerable quantity. It is a woody nut, ¼ of an inch long, formed by the fusing together of the different parts of the perianth and ovary, somewhat triangular in form; at the base are spines formed by the calycine segments; at the apex the perianth forms a number of tooth-like processes which surround the top of the ovary. The seed is ovoid, horny, and has a terebinthinate odour.

Chemical composition.—The chopped plant, air-dried, was treated for several days with warm 80 per cent. spirit, the resulting tincture distilled to remove alcohol, and the residue finally deprived of the last traces of alcohol by spontaneous evaporation. The extract was then mixed with water acidulated with sulphuric acid and agitated with petroleum ether. The petroleum ether extract was greenish, soft, with a camphoraceous and peppermint odour and taste. Treated with warm proof spirit a portion dissolved, forming a clear yellowish liquid while warm, but from which resinoid matter separated on cooling. The solution had a strongly acid reaction and gave a greenish coloration with ferric chloride. After the addition of sulphuric acid, it afforded a very marked precipitate with Mayer's and other alkaloidal reagents. With alkalies the solution was coloured of a bright yellow hue; basic acetate of lead gave a bright yellow precipitate, a similar precipitate, but smaller in amount, being also afforded by lead acetate. The soft resinous residue insoluble in proof spirit, after standing deposited a small amount of bright yellow matter which was destitute of crystalline structure on microscopic examination. In ammonia the residue was insoluble.

During agitation of the extract with petroleum ether a considerable amount of dark, soft resin separated; this resin had a marked peppermint odour, and was only partly soluble in ether. After repeated washing with ether, it was left as a dark, soft mass which could be kneaded by the fingers; on drying at 100°C. a nearly black brittle mass was left, easily pulverised

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and forming a dark olive-brown coloured powder, odourless and tasteless, but bitter in an alcoholic solution, soluble in ammonia, forming a deep yellowish brown solution, from which it was reprecipitated by acids in dirty yellowish white flocks. In alcohol the resin was easily soluble with acid reaction; with ferric chloride the alcoholic solution was slightly darkened in tint.

After agitation with petroleum ether the acid aqueous solution was agitated with ether: the ether extract was small in quantity, and though some small points separated on the sides of the dish which appeared crystalline on naked-eye inspection, on microscopic examination no crystalline forms were visible. In water the extract was partly soluble with strong acid reaction: the aqueous solution gave with ferric chloride a dirty bluish-green precipitate, changing almost instantly to dirty whitish-brown. With alkalies a bright yellow coloration was afforded; the solution did not precipitate gelatine and gave no reaction with cyanide of potassium. The ether extract was treated with ammonia, in which, with the exception of some flocks, it appeared to be wholly soluble. The solution exhibited a marked greenish fluorescence; it was agitated with ether. The ether extractive formed a non-crystalline yellow varnish, soluble in alcohol without fluorescence, with a very bitter taste and neutral reaction; treated with dilute sulphuric acid a small portion dissolved, and the solution afforded marked reactions with all alkaloidal reagents. The alkaline aqueous solution was acidulated, which caused whitish flocks to separate, and agitated with ether. The ether extract was a non-crystalline yellow varnish, partly soluble in water with strong acid reaction, the solution affording similar reactions to the original aqueous solution of the ether extract. The ammoniacal solution exhibited a greenish fluorescence.

The original aqueous acid solution was now rendered alkaline and reagitated with ether; a yellow varnish was obtained after spontaneous evaporation of the ether. The extract was treated with dilute sulphuric acid and agitated with ether, the ether separated, the aqueous solution rendered alkaline, and again agitated with ether, in order to purify any alkaloidal principle

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which might be present. The purified ether extract dried to a yellow varnish; the solution in sulphuric acid gave a very marked yellowish precipitate with Mayer's reagent; a white precipitate with alkalies; with Fröhde's reagent, a precipitate first yellowish, rapidly changing to pale blue, and darkening, on standing or warming, to deep prussian blue; chromate of potash gave a yellow precipitate; bichromate of potash and concentrated sulphuric acid, a dirty orange-red; ferric chloride no reaction; the solution was destitute of any bitter taste. Considerable loss of alkaloid occurred during its purification, as the sulphate was somewhat soluble in ether.

Finally the original alkaline aqueous solution was acidulated with sulphuric acid, and agitated with amylic alcohol. On evaporating off the amylic alcohol, a deep orange-red varnish was left, partly soluble in water with strong acid reaction, the solution giving an olive-brown coloration with ferric chloride; no precipitate with gelatine; a bright yellow coloration with alkalies; a bright yellow precipitate with basic acetate of lead; and it reduced Fehling's solution on boiling. The residue, insoluble in water, was dissolved by ammonia, forming a deep orange-yellow solution from which acids afforded a whitish precipitate, the yellow colour being destroyed.

SPINACIA OLERACEA, *Linn.*

Fig.—*Lamk. Encycl.*, *t.* 814; *Wight Ic.*, *t.* 818. Spinach (*Eng.*), Epinard (*Fr.*). Syn. *S. tetrandra*, Stev.

Hab.—Persia. Cultivated in India. The herb and fruit.

Vernacular.—Pálak (*Hind.*), Pálang (*Beng.*), Vusayley-keeray (*Tam.*).

History, Uses, &c.—This potherb is a native of Persia; it is described in the Persian *Burhán* under the name of اسپناخ (ispanákh) as a potherb much used in broth. The name is now often incorrectly pronounced *Ispanáj* by the Persians, and *Isfanáj* or *Isfánáj* by the Arabs. The plant has been introduced into India by the Mahometans, and is now cultivated in many

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parts of the country. The African Moors brought it to Spain, whence its use gradually spread to other parts of Europe. It was known in England as *Spinach* in 1568, and is noticed in *Turner's Herbal*, published in that year, as "lately introduced and not much in use." Aitchison, in his *Botany of the Afghan Delimitation Commission*, remarks that it grows profusely in the vicinity of Simkoh in the Badghis, and is collected as a potherb by the natives. He says:—"I have no doubt Mr. De Candolle is correct in assuming *S. tetrandra* to be the wild form of *S. oleracea.*" Spinach is much valued by the Mahometans on account of its cooling and emollient properties, and the seeds are sold in all the Indian bazars. A decoction of the plant is prescribed in febrile affections, in lithiasis, and in inflammation of the lungs or bowels. The juice of the leaves is also used as a diuretic and as a gargle in sore-throat. Poultices of the leaves or boiled seeds are applied to soften tumours and promote the maturation of boils. The herb is considered one of the most digestible and wholesome of vegetables.

Description.—The plant has large, thick, succulent, deep-green leaves, of a somewhat triangular form, produced on long foot stalks. The stem is erect, large, round and hollow, about two feet high. The male plants are distinguished by their long terminal spikes of green flowers, while those of the females are axillary, sessile and clustered. The fruit is prickly in some varieties and smooth in others.

Chemical composition.—Besides a large quantity of mucilage spinach contains so large a proportion of nitrates, that the water in which it has been boiled may be used for making touch-paper. The following figures give the mean percentage composition of three samples of spinach recorded by König :—

Water	88·47
Nitrogenous matter	3·49
Fat	0·58
Sugar	0·10
Nitrogen-free extractive	4·34
Fibre	0·93
Ash	2·09

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Anhydrous spinach contained, as the mean of three analyses of different samples,—

Nitrogen .... 4·94
Carbohydrates .... 37·93

Basella alba, *Linn.*, *Wight Ic.*, *t.* 896, is known as Indian spinach, or Malabar Nightshade, and the juice of the leaves, which is demulcent and cooling, is a popular application to allay the heat and itching of urticaria arising from dyspepsia, an affection which the Hindus consider to be indicative of bile in the blood. The boiled leaves are also used as a poultice. This herb is extensively cultivated as a vegetable, and bears the vernacular names of Poi (*Hind.*), Mayál (*Mar.*), Vasala (*Tam.*), Bachchali (*Tel.*), and Bili-basale (*Can.*). The generic name is derived from the Tamil. The Sanskrit name is Potaki or Upodika.

Many plants of this order are used as potherbs in the East. In Persia and Biluchistan, **Chenopodium Botrys,** *Linn.*, **C. Blitum,** *Hook. f.*, and **Atriplex Moneta,** *Bunge*, are much used. On the Indian coasts, **Arthocnemum indicum,** *Moq.*, a plant of the salt marshes, is used as a vegetable, and is also pickled. Fryer, who visited Bombay in 1694, calls it "samphire."

Plants more generally known as vegetables are **Chenopodium album,** *Linn.*, **C. ambrosioides,** *Linn.*, **Beta vulgaris,** *Linn.*, and **Atriplex hortensis,** *Linn.* The seeds of the Beet are sold in Indian Bazars for medicinal use, under the name of Chukandar.

POLYGONACEÆ.

POLYGONUM AVICULARE, *Linn.*

Fig.—*Eng. Bot.*, 1252. Knot-grass (*Eng.*), Renouée des oiseaux (*Fr.*).

Hab.—Northern Asia, Europe. Introduced into India. The root and seeds.

Vernacular.—Machoti, Bijband, Kesri (*Hind.*), Endráni (*Sind.*)

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History, Uses, &c.—This plant is identified by Fée with the male πολύγονον of Dioscorides, a vulnerary and astringent herb, the Polygonos of Pliny (27, 91). It was used by the ancients to arrest hemorrhage, the seeds were considered to be laxative and diuretic and to arrest defluxions. For burning pains in the stomach the leaves were applied topically, and were used in the form of a liniment for pains in the bladder and for erysipelas. The juice was administered in fevers, tertian and quartan more particularly, in doses of two cyathi, just before the paroxysms. Scribonius (*Comp.* 46) says that it received its name "polygonos" from its being found everywhere. Ibn Sina and other Arabian physicians call the plant A'sa'r-ra'i (عصا الراعى) and Batbát (بطباط); they consider it to be cold and dry, and reproduce what the Greeks have said concerning its medicinal uses. The Persians call it Hazàr-bandak. It is the *Polygonum mas* of Matthiolus (*Valgr.* ii., 300).

In India the plant is still used by the Hakims in the diseases named by Dioscorides.

In our own times Polygonum root has been used as a febrifuge in Algeria, and has been reported upon as being an excellent remedy for chronic diarrhœa and stone in the bladder. Its value has apparently been much exaggerated. (*J. R. Jackson, Amer. Journ. Pharm.*, 1873, 247.)

In the *Lancet* (1885, 658) it is said to be used in Russia, under the name of *Homeriana,* as a popular remedy in lung affections. Dr. Rotschinin, who has experimented with the drug, found it really valuable in several cases of bronchitis, two of which were capillary; also in three cases of whooping cough. It was tried in phthisis, but no definitely satisfactory results were obtained. A tumblerful of the decoction was given three times a day.

Description.—Root fibrous, long, very tough, and somewhat woody; branched below, simple at the crown. Stems several, spreading in every direction, generally prostrate, much

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branched, round, striated, leafy at the numerous knots or joints. Leaves alternate, stalked, hardly an inch long, elliptic or lanceolate, entire, obtuse, single-ribbed, smooth except at the margin, tapering at the base, very variable in width, substance rather coriaceous, colour greyish or glaucous. Flowers variegated with white, crimson and green. Seeds acutely triangular, of a shining black.

Polygonum Bistorta, *Linn.*, is the *Anjubár* of the Western Arabs, and their description of it is still reproduced in Indian medical works. **P. viviparum**, *Linn.*, a nearly allied species, is used as a substitute for it in the Punjab, under the same Arabic name, and is called in the vernacular Maslun and Bilauri. The **Anjubar-i-Rumi** of the bazars, imported from Persia, is a thick reddish-brown astringent root-bark, evidently obtained from a tree or shrub of some size, and it may be observed that Aitchison found an arboreous species of Polygonum growing in the Badghis and Paropamisus.

Other species of Polygonum which have been used medicinally, and which occur in India, are:—

P. glabrum, *Willd.*, **P. Hydropiper**, *Linn.*, **P. molle**, *Don.*, **P. barbatum**, *Linn.*, and **P. alatum**, *Ham.* All these plants are astringent, but *P. Hydropiper* also contains a pungent volatile principle having acrid properties.

Chemical composition.—Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, Nov. 1879) separated from *P. Hydropiper* a crystalline principle which he named *Polygonic acid.* H. Trimble and H. J. Schuchard (*Amer. Journ. Pharm.*, Jan. 1885) re-examined the plant with the following results:—They found that the peculiar pungent principle, although present in a weak alcoholic tincture, disappeared on distillation, the pungent taste of the herb being absent both from the distillate and the residue in the retort.

From these experiments they conclude that the active principle is decomposed on the slightest heating, and that the only

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proper preparation of the drug would be one made without the application of heat. They prepared the polygonic acid of Dr. Rademaker, and conclude from their experiments that it is only a mixture of impure tannic and gallic acids.

The following summary shows the amount of the most important constituents :—

	Per cent.	
Water	10·25	
Wax	2·70	From petroleum spirit solution.
Resin and chlorophyll	1·54	From ether solution.
Resin, tannin, and chlorophyll.	5·14	From alcoholic solution.
Sugar	1·44	From aqueous solution.
Gum	·55	
Tannin and extractive	5·23	
Albuminoids	1·00	From alkaline solution.
Phlohaphene, &c.	5·95	
Salts and a small amount of extractive	6·00	From dilute acid solution.
Cellulose	57·45	
	97·25	

Separately determined : tannin, 3·46 per cent. ; ash, 7·40 per cent. (*Year-Book of Pharm.*, 1885, p. 160.)

Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, June 1886) re-asserted the existence in this plant of the active crystalline principle, described by him as polygonic acid, and supplied further details respecting its extraction and properties, together with a wood-cut illustration of its crystals. He says:— "Polygonic acid may be prepared by treating the plant with water, to which some bicarbonate of sodium has been added, and allowing it to macerate for 24 hours; or by precipitating

a fluid extract with basic acetate of lead. In each case separate the base by means of sulphuric acid, and the organic acid by means of ether. Allow the ethereal solution to evaporate, and treat the residue with distilled water, and filter; this separates the resin (resinous acid). The filtrate is then filtered through animal charcoal repeatedly, until all colouring matter is removed. The filtrate is next treated with solution of gelatine, in order to remove any tannic acid that might be present, again filtered, and evaporated to dryness, redissolved in ether, and the ethereal solution allowed to evaporate spontaneously. Polygonic acid thus prepared crystallizes in needles. Its solution in water does not precipitate gelatine nor produce a bluish-green coloration when added to a mixture of ferrous and ferric salts in solution, showing absence both of gallic and tannic acids. It is freely soluble in water, less so in ether, and insoluble in petroleum spirit. The heat of a water-bath does not destroy any of its properties. (*Year-Book of Pharm.*, 1886, p. 210.)

The other species of Polygonum which have been examined contain starch and tannic and gallic acids. Bowman (1869) obtained 21 per cent. of tannic acid from Bistort root. In the Bengal Chemical Examiner's Report for 1884 we meet with the following notice of *P. glabrum*: "Several specimens of a plant called *Bish-kurki* were sent from Cachar for examination. It was stated that the plant was frequently added to country spirit, which it was believed might have thus communicated to it some specially noxious property. The plant was identified by Dr. G. King as *Polygonum glabrum*, and on chemical examination and physiological application was not found to possess toxic properties."

RHEUM OFFICINALE, *Baillon.*

Fig.—*Bentl. and Trim., t.* 213. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

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RHEUM PALMATUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 214. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

Vernacular.—Rewand-chini, Lakri-rewand-chini (*Ind. Bazars*).

History, Uses, &c.—The Chinese appear to have been acquainted with the properties of rhubarb from a period long anterior to the Christian era, for the drug is treated of in the herbal called *Pen-king*, which is attributed to the Emperor Shen-nung, the father of Chinese agriculture and medicine, who reigned about 2700 B.C. The drug is named there *Huang-háng*, yellow, excellent, and *Ta-huang*, the great yellow. The latter name also occurs in the great Geography of China, where it is stated that rhubarb was a tribute of the province Si-ning-fu, eastward of Lake Kuku Nor, from about the 7th to the 10th centuries of our era.

As regards Western Asia and Europe, we find a root called ῥᾶ or ῥῆον, mentioned by Dioscorides as brought from beyond the Bosphorus. Pliny describes a root termed *Rhacoma*, which, when pounded, yielded a colour like that of wine, but inclining to saffron, and was brought from beyond Pontus. The drug thus described is usually regarded as rhubarb, or at least as the root of some species of Rheum. Lassen has shown that trading caravans from Shensi in Northern China arrived at Bokhara as early as the year 114 B.C. (*Pharmacographia.*)

Riwás (the plant Ri in the Zend language) was known to the ancient Persians, and the same name is still applied to a species of Rheum in the province of Gilán in Persia. Aitchison found *R. Ribes*, Gronov., on the Paropamisus range, to be known to the peasantry as Rewash, Rewand and Chukri; he states that the flowering branches are eaten, and the root used in colouring leather. In the Hari-rud Valley he found *R. tataricum*, Linn., f., to be known as Rewash-i-dewána, "fools' rhubarb," the fruit and root being used as a purgative. Ibn Sina (978)

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notices both the plant Ribás (Riwás, *Pers.*) and the drug Ráwand (Rewand, *Pers.*)—the first an acid plant, and the second evidently Chinese rhubarb. Mesue, early in the 11th century, distinguishes between Chinese and Khorasan rhubarb, and Haji Zein-el-attár, writing in 1368, says:—"I consider Rewand to be the same as Ribás. Ibn Jazla, the author of the *Minháj*, states that there are two kinds, China and Khorasan rhubarb, and that the latter is known as Ráwand-el-dawább, and is used in veterinary practice, whilst the Chinese is reserved for human beings. The latter is the best kind, and, when powdered, is of a saffron colour; the fractured surface has the grain of a cow's hump, and is friable; it is called Rewand-i-lahmi (meaty rhubarb), and should be in large pieces like a horse's hoof, and not worm-eaten. In my experience there are three kinds of rhubarb—Chinese, Khorasan, and Indian. Masih (Mesue) states that rhubarb is hot in the third degree and dry in the first." (*Ikhtiárát*, article *Ráwand.*)

The author of the *Makhzan-el-Adwiya*, himself a native of Khorasan, has the following account of Ribás:—"It is called in Persian Riwás, Riwáj and Chukri, and is an herbaceous plant a cubit in height; from the centre spring one or two flattened stems, 2 fingers by 1 finger in thickness, having a pubescent bark, the lower portion of which is purplish and the upper green, like the stem of a lettuce. Internally the stem is white, soft and juicy; it has a sour and somewhat astringent taste. The top of the stem is branched, and between the branches are green rough bracts; the flowers are red, and have a slightly acid and sweetish taste. The plant grows in the cold snowy mountains; the best is the Persian, white, delicate, succulent and subacid, with a stout tall stalk. The root of this plant is rhubarb (Ráwand), which has already been described, and it is called 'Ribás-i-Mu'ammiri,' because one Mu'ammir of Nishapur was the first to discover this." For the history of rhuharb in Europe, the reader is referred to the *Pharmacographia.*

Rhubarb is not an article of the Hindu Materia Medica, but the modern Hindus have become acquainted with its properties through Mahometan and European physicians.

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In the use of rhubarb as a medicine, the Mahometans quote and follow Galen, Oribasius, Paulus, Rází, Ibn Sina and Masih, whose opinions it is unnecessary to reproduce. In India it is chiefly used as a stomachic, tonic, and mild aperient.

The rhubarb found in the Indian bazars is of a very inferior kind, in long stick-like pieces, shipped to Calcutta and Bombay from the Eastern ports. It comes from China, and has hardly any aroma, a bitterish taste, and but slight purgative action. When fresh, it is covered with a yellow dust, like ordinary rhubarb. The natives use it as a tonic and stomachic. None of the commercial rhubarb known as East Indian is imported into Bombay unless specially ordered from China, but it often passes through the port on board the P. and O. Company's steamers. Bombay druggists, Native and European, usually obtain their rhubarb from London. On account of its low price, the former always import English rhubarb. In the *Pharmacopœia of India*, the bazar rhubarb of India is attributed to *Rheum emodi*, *R. Moorcroftianum*, and *R. Webbianum*, all Himalayan species; it is said to be of two kinds, large and small: "The first in cylindrical pieces of various sizes and shapes, furrowed; cut obliquely at the extremities, about four inches long and an inch and a half in diameter; of a dark-brown colour, feeble rhubarb odour and bitter astringent taste; texture radiated, rather spongy, not presenting on fracture the marbled texture characteristic of ordinary rhubarb; pulverized with difficulty; powder of a dull brownish-yellow colour. The second consists of short transverse segments of the root branches; of a dark-brownish colour, odourless or nearly so, with a very bitter astringent taste." (*Op. cit.*, p. 187.) The first kind so exactly corresponds with the stick rhubarb imported from China, that we are of opinion that it was not Himalayan rhubarb, whilst the second probably was of Indian origin. Trials made with Himalayan rhubarb by Prof. Royle (*Calcutta Med. and Phys. Trans.*, iii., p. 439) and Mr. Twining (*Diseases of Bengal*, i., p. 220) are reported to have been satisfactory, and Dr. Hugh Cleghorn (*Madras Quart. Med. Journ.*, 1862, v., p. 464), who furnishes some interesting remarks on

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Himalayan rhubarb, states that it is only an inferior variety that reaches the plains of Hindustan. He tested the action of the fresh root, and found it to resemble the action of Russian rhubarb. (*Op. cit.*, p. 188.)

Description.—China rhubarb consists of portions of a massive root which display considerable diversity of form, arising from the various operations of paring, slicing and trimming to which they have been subjected. Thus some pieces are cylindrical or rather barrel-shaped, others conical, while a large proportion are plano-convex, and others again are of no regular shape. These forms are not all found in the same package, the drug being usually sorted into *round* and *flat rhubarb*. The pieces are from 3 to 4 inches long by 2 to 3 inches in breadth. Many pieces are pierced with a hole. The drug is dusted over with a bright brownish-yellow powder, on removal of which the surface is seen to have a rusty-brown hue. The character which most readily distinguishes the rhubarb of China is that well-developed pieces, broken transversely, display dark lines arranged as an internal ring of star-like spots. In good rhubarb the interior is compact and veined with reddish-brown and white, sometimes mixed with iron-grey. The root when chewed tastes gritty, by reason of the crystals it contains of oxalate of calcium; but it is, besides, bitter, astringent and nauseous. The odour is peculiar. (*Pharmacographia.*) The characters of the *Chinese stick rhubarb* which is used in India have already been noticed; it would appear to consist of the smaller branches of the root which have been removed in preparing the drug for European commerce.

Chemical composition.—The purgative principle of rhubarb is *Cathartic acid*, a glucoside discovered by Kubly (*Bull. Soc. Chim. Paris*, 1866) in Senna in combination with calcium and magnesium, and now known to be present in many other purgative drugs. Rhubarb also contains *Chrysophanic acid*, $C^{15}H^{10}O^{4}$, and an allied substance *Emodin*, $C^{15}H^{10}O^{5}$; a tannin, $C^{26}H^{26}O^{14}$, named Rheo-tannic acid by Kubly; resins and mucilaginous matters. Small quantities of albuminoid substances, malic acid, fat and

sugar have also been met with in rhubarb. The amount of the mineral constituents is exceedingly variable: Flückiger and Hanbury obtained from two good samples of China Rhubarb, dried at 100°C. and incinerated, 12·9 and 13·87 per cent. of ash; another pale sample yielded no less than 43·27 per cent. The ash consists of carbonates of calcium and potassium.

The following analyses by Elborne show the percentage composition of three samples of English Rhubarb and two of the Eastern drug :—

	R. officinale, ordinary cultivation.	R. officinale, high cultivation.	R. rhaponticum.	East Indian Rhubarb.	Russian Rhubarb.
Moisture	6·06	7·9	5·57	5·4	12·6
Ash	9·33	4·9	7·9	9·28	6·63
Mucilage (soluble in water)	6·5	4·8	4·1	4·0	5·5
Cathartic acid	3·5	3·2	3·3	4·5	3·2
Tannin and chrysophan	14·3	11·7	12·5	11·7	11·0
Organic acid	3·3	2·2	1·5	3·0	4·5
Resinous substances soluble in alcohol	2·6	2·0	3·4	4·6	5·2
Fat and free chrysophanic acid soluble in petroleum ether	0·4	0·3	0·2	0·7	1·5

Rumex vesicarius, *Linn.*, *Campd. Rum.*, 129, *t.* 3, *f.* 1. 8; Chúka (*Hind.*, *Beng.*, *Bomb.*), Chúkra (*Sans.*), is cultivated all over Asia, and is used just as sorrel is in Europe; excellent 'potage à l'oseille' may be made with it The plant is, doubtless, one of the kinds of Hamáz (Dock) mentioned in Arabic works, and is much esteemed for its medicinal properties. The juice is said to allay the pain of toothache, and by its astringent properties to check nausea, promote the appetite, and allay morbid craving for unwholesome substances. The herb also is considered very cooling and of use in heat of stomach, and externally as an epithem to allay pain, especially that caused by the bites or stings of reptiles and insects. The seeds are said to have similar properties, and are prescribed roasted in dysentery, and as an antidote to scorpion stings. The root is also medicinal.

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Description.—The fruit sold in the shops as Gulhamáz (Dock flowers) is reddish-brown, about $\frac{1}{10}$ of an inch long, and consists of three fringed, leaf-like expansions, each furnished with an oblong glandular body and attached at the base to a short thick pedicel; they enclose a triangular, polished, dark-brown seed.

Bijband.—Shining angular seeds (nuts), evidently derived from a species of Rumex. They are used as an aphrodisiac. Murray states that the fruit of *Polygonum aviculare*, Linn., is known as Bijband or Endraní in Sind. According to Atkinson, *Rumex Wallichii*, Meissn., referred by Hooker to *R. maritimus*, Linn., yields the Bijband of the bazars. Probably the seeds of several species are collected.

Rumex Patientia, which Hooker thinks, along with *R. aquaticus*, Linn., might be united with *R. orientalis*, Bernh., has been examined by W. Dahlen, who gives the following percentage composition:—Water, 92·18; Nitrogenous matter, 2·42; Oil, 0·48; Sugar, 0·37; Nitrogen-free extractive, 3·06; Fibre, 0·66; Ash, 0·82.

This plant is a native of the Western Himalaya and extends westward to Asia Minor, Syria and Greece; it was named by Hayne *R. Dioscoridis* (*Arnseik.* xiii., 5, *t.* 5), from its having been identified with the λαπάθον of the ancients, and it is still called λαπαθο in Greece.

ARISTOLOCHIACEÆ.

ARISTOLOCHIA INDICA, *Linn.*

Fig.—*Wight Ic., t.* 1858; *Griff. Ic. Pl. Asiat., t.* 529; *Rheede, Hort. Mal. viii., t.* 25. Indian Birthwort (*Eng.*).

Hab.—Throughout the low country of India. The stem and root.

Vernacular.—Isharmúl, Rudrajata (*Hind.*), Ishormúl (*Beng.*), Sápsand, Ishvari, Rudrajata (*Mar.*), Sápsan, Ishwari (*Guz.*),

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Ichchura-mula, Peru-marindu (*Tam.*), Ishvara-veru, Govila (*Tel.*), Ishvari-beru, Nanjin-beru (*Can.*), Karalvekam, Ishvara-muri (*Mal.*), Sápús (*Goa*).

History, Uses, &c.—This scandent shrub is the Rudra-jata of the Rája Nirghanta; other Sanskrit names for it are Arkamúla, "lightning root"; Ishvari, "goddess"; Sunanda, "pleasing"; and Sudhy-upásya, "worthy of worship." It is considered to be attenuant, deobstruent, emmenagogue, antarthritic, and a valuable medicine in the bowel affections of children who are teething. In the Mahometan Materia Medica it is known as Zarawand-i-Hindí, and is admitted as an Indian substitute for Zarawand (*Aristolochia longa*). The early Portuguese settlers in India gave it the name of Raiz de Cobra, on account of its supposed efficacy against the bite of that snake.

The plant was first described by Rheede, who compares its odour to that of fresh ginger, and states that boiled in oil it is applied as a liniment to snake-bites, and a decoction given internally. It is also administered, rubbed to a paste with water or in decoction, in cold fevers, headache, flatulent distention, and dysuria. As a lotion it relieves gouty pains, and the powder with pepper and hot water stops bloody fluxes.

It appears to be the *Radix puloronica* of Rumphius, which is employed in Banda in decoction, in diseases of the intestines, and also in intermittent fevers. Ainslie (*Mat. Ind.*, ii., 298) notices its use by the Tamil doctors in the bowel complaints to which children are subject in consequence of indigestion and teething, and says they sometimes call the drug *Talashroolivayr*. He also says that the powder is taken internally in cases of snake-bites and applied to the bitten part. Loureiro (*Flor. Cochin-Chin.*, vol. ii., p. 528), speaking of the plant, says: "Prodest in colica, cibi inappetentia, febribus intermittentibus, obstructionibus, hydrope." Fleming (*Catalogue of Indian Plants*, p. 8) notices its use in Upper India as an emmenagogue and antarthritic.

The plant is placed in the secondary list of the *Pharmacopœia of India*, but no further information with regard to its medicinal

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properties is given. In Bombay Sápsan is chiefly prescribed in the bowel complaints of children and in cholera; it is regarded as a stimulant tonic, and is also applied externally to the abdomen. Babu T. N. Mukharji states that the juice of the fresh leaves is very useful in the croup of children, by inducing vomiting, without causing any depression. (*Amsterdam Cat.*, p. 21.)

Description.—The drug as sold in the shops consists of the root and stem, the latter in by far the larger proportion; in many parcels the stem only is to be found It is either in short pieces, or the whole stem may be twisted into a kind of circular bundle. The thickest portion of the stem is ¼ to ½ an inch or more in diameter, and has a central woody column made up of about ten wedge-shaped portions. The bark is thick and corky, marked with longitudinal ridges and numerous small warty projections; it is of a yellowish-brown colour. The taste is bitter and camphoraceous, and the odour aromatic and agreeable.

Microscopic structure.—The wedge-shaped woody columns are traversed by large vessels, the medullary rays are distinct and easily traced into the bark; in the latter, which consists of starchy and corky parenchymatous tissue, there is a circular zone of large yellow stone-cells.

Chemical composition.—The air-dried roots were contused and digested for several days with warm 80 per cent. alcohol. The greater part of the alcohol from the resultant tincture was removed by distillation, but the last traces could be separated by spontaneous evaporation with difficulty, owing to soft resinous matter separating and floating on the surface and thus preventing evaporation. The extract still containing alcohol, and which possessed a strong smell of the drug, was mixed with water and agitated with light petroleum ether. During agitation a dark viscid resinous mass separated, as well as a small amount of a bright yellow powder. The clear aqueous solution, after separation of the petroleum ether, was gently heated to expel alcohol, and the residue acidified with sulphuric acid and agitated with ether. After separation of the ether, the aqueous

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solution was rendered alkaline and reagitated first with ether, then with chloroform, and lastly with amylic alcohol.

The dark resinous matter which separated on agitation with petroleum ether was repeatedly shaken with ether, in which a portion was soluble. The ethereal extract was of the consistence of honey, had a taste and smell like that of a mixture of turpentine and peppermint, and was also bitter: in alcohol it was soluble with acid reaction; it was dissolved by ammonia, forming a dark reddish orange-coloured solution, and was reprecipitated by acids in yellowish flocks. The residue insoluble in ether was soft when moist and dark chocolate in colour: on drying at 100°C. it became brittle, and could be easily reduced by pressure between the fingers to a yellowish powder which possessed neither taste nor odour: in alcohol it was soluble with acid reaction: in ammonia the greater part dissolved, and was reprecipitated in yellow flocks by acids. The bright yellow powder was soluble in ether, and was left on spontaneous evaporation as a bright yellow varnish, destitute of crystalline structure. In warm water the greater part dissolved, forming a pale yellow solution which became turbid on cooling and which had a marked acid reaction. In alkalies it was soluble with deep orange coloration, and was reprecipitated by acids in pale yellow flocks: with ferric chloride it gave a dirty brownish-red precipitate: with basic acetate of lead, yellowish flocks: with baryta water no precipitate, only a deep yellow coloration.

The light petroleum ether extract was soft and brownish in colour, and had a strong odour of turpentine; on gently heating in a small retort, a trace of a distillate was obtained which had a most powerful terebinthinate odour and taste.

The extract obtained by agitating the original aqueous acid solution with ether was a bright yellow, transparent, soft, varnish-like mass, from which slowly separated a few small yellowish nodules, which, on microscopic examination, were found to consist of bundles of rod-shaped crystals. The extract was soluble in alcohol with strong acid reaction, the solution exhibiting a well-marked greenish fluorescence, as did also an ethereal solution.

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The taste was very bitter, aromatic, and also somewhat terebinthinate. On treatment with ammonia the extract was partly dissolved, yielding a deep orange-red solution, which was agitated with ether, the ether showing a marked greenish fluorescence. On evaporating off the ether, a bright yellow, viscid, transparent extract was left, with a bitterish taste, accompanied by a strong one of turpentine. In alcoholic solution the extract was neutral in reaction, the solution exhibiting a marked fluorescence. The ammoniacal solution, after separation of the ether, was acidulated with sulphuric acid and reagitated with ether. On evaporation of the ether, a bright yellow, soft, varnish-like residue was left; on heating with water the greater part dissolved, forming a clear solution which became turbid on cooling. With alkalies the extract gave a deep orange-red solution: with ferric chloride a dirty brownish-red precipitate: with basic lead acetate yellowish flocks were precipitated: with lime and baryta water a yellowish coloration, but no precipitates. After boiling with dilute sulphuric acid, Fehling's solution was reduced. The reactions of this acid were, therefore, similar to those of the *yellow powder* which separated on agitation with petroleum ether.

The original solution after addition of sulphuric acid was rendered alkaline with ammonia and agitated with ether. On spontaneous evaporation of the ether, a yellow, soft, non-crystalline, transparent, varnish-like extract was left. This was treated with a little dilute sulphuric acid, in which a portion only dissolved, and agitated with ether, which removed resinous matter. The ether was then separated, and the aqueous solution rendered alkaline, and reagitated with ether. A yellow non-crystalline extract was obtained, which was nearly wholly soluble in dilute sulphuric acid, and which afforded the following reactions: with ammonia a white precipitate soluble in excess: with caustic soda a similar precipitate, only slightly soluble in excess: with platinic and auric chlorides yellow precipitates: marked yellow precipitate with Mayer's reagent, and with other alkaloidal reagents: with strong nitric acid a yellowish coloration: with Fröhde's reagent a deep-blue coloration in the cold, no alteration in tint on gently heating. After boiling with

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dilute sulphuric acid, the liquid slightly reduced Fehling's solution.

After agitation with ether, the liquid was agitated with chloroform, which separated an alkaloidal principle mixed with much colouring matter. The reactions were similar to those yielded by the principle extracted by ether.

Finally the liquid was agitated with amylic alcohol, the alcohol exhibiting very marked greenish fluorescence. The amylic alcohol extract contained a large amount of resinous matter insoluble in dilute sulphuric acid; the acid solution afforded, however, very marked evidence of the presence of a principle reacting with alkaloidal reagents, the colour reactions being similar to those yielded by the principle separated by ether and chloroform. It would be premature for us to definitely state that the principles extracted by ether, chloroform, and amylic alcohol were either identical or different.

Toxicology.—Dr. S. M. Shircore of Moorshedabad states that it is undoubtedly used to procure abortion.

Commerce.—The drug can hardly be called an article of commerce, as it is supplied to the shops by herbalists or country people. It is very abundant in the Southern Concan. Value, annas 6 per pound.

ARISTOLOCHIA BRACTEATA, *Retz.*

Hab.—Deccan Peninsula to Bandelkand, Sind, Ceylon. The herb.

Vernacular.—Kiramár, Gandháni (*Hind.*), Kiramár (*Guz.*), Gandhán-gavat, Gándháni (*Mar.*), Ganajali-hullu, Kattagiri (*Can.*), Adutina-pálai (*Tam.*), Gádide-gadapara-áku, Kadapara (*Tel.*), Átutinta-pála (*Mal.*).

History, Uses, &c.—This plant is the Dhúmra-pattra of the Rája Nirghanta, *i.e.*, the plant with grey leaves. The synonyms are:—Dhúmráhva, Su-labhá, Svayam-bhuva, Gridhra pattra, Gridhráni, Krimi-ghni, Srima-lápaha. It is much used

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by Hindu physicians on account of its bitter, purgative, and anthelmintic properties. The leaves are applied to the navel to move the bowels of children, and are also given internally in combination with castor oil as a remedy for colic. The juice of the fresh leaves or the powder of the dried leaves is a favourite application to sores to destroy maggots. In the Kurnool District, when the *sazza* is attacked with insects, a long rope soaked in the juice of the plant, and with the leaves of the plant attached, is drawn over the crop. Dr. Hové, who visited Bombay in 1787, found the plant growing in great abundance in Guzerat. He states that the root and leaf are remarkably bitter, and yield a thick yellowish juice, which is mixed with boiled milk and given in syphilis, and combined with opium is used with great success in gonorrhœa. Ainslie notices the application of the leaf, when bruised and mixed with castor oil, to obstinate psora (the Carpang of the Tamils). The plant is also thought to stimulate uterine contraction, and is administered in tedious labour and as an emmenagogue. In Dalzell and Gibson's *Flora of Bombay* (p. 225) it is spoken of as possessing a merited reputation as an antiperiodic in intermittent fevers. The native doctors in Bombay make a paste with water, of the plant, along with the seeds of *Barringtonia acutangula*, *Celastrus paniculata*, and black pepper, and rub the whole body with it for the cure of malarial fevers.

The evidence collected by Dr. Watt (*Dict. Econ. Prod. India*, i., 314) shows that it is the opinion of several European physicians in different parts of India that the plant has a decided action upon the uterus, and increases or induces uterine contractions. There appears to be no doubt as to its anthelmintic properties.

Description.—The drug consists of the whole plant in fruit; the stems are striated, slender, and about as thick as a piece of whipcord; the leaves are of a pale, glaucous green, obtuse, heart-shaped, with wavy edges, about 2 inches long and 1½ inch broad, when dry they are blackish; the capsules are ovate, ¾ of an inch long, ribbed, depressed at the apex, six-celled;

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each cell contains a column of heart-shaped flat seeds, closely packed. The appearance of the seeds is peculiar, they look as if they had been cut out with a punch; one side is flat, black, and rough from a number of irregular projections; the other is almost entirely occupied by two brown comparatively smooth lobular projections of a soft corky structure; these under the microscope are seen to be entirely composed of ovate, empty, dotted cells. The whole plant is nauseously bitter.

Chemical composition.—The plant contains a nauseous volatile substance, an alkaloid, and a large quantity of salts. The alkaloid is amorphous and gives no colour reactions with the strong mineral acids. The bitter concentrated tincture on standing deposited cubical crystals of potassium chloride. The ash calculated on the air-dried plant was 17·75 per cent., and strong alkaline fumes were given off from the plant when burning.

Commerce.—Value, Rs. 3½ per maund of 37½ lbs.

Zarawand-i-gird (*Pers., Ind. Bazars*). The imported root of *Aristolochia rotunda*, Linn., *Guib. Hist. Nat.*, ii., p. 371, a small plant with slender stems and almost sessile, obtusely cordiform leaves. The flowers are solitary in the axils of the leaves, tubular, yellow without, and orange brown within. The whole plant is acrid, aromatic and bitter. The root is tuberous, placentiform, hard and heavy when dry, more or less mammillated on the under surface, of a reddish-brown colour; on the upper surface are the remains of several stems or small pits showing where they were attached; on the under surface one central scar marking the attachment of the rootlets. The substance is very hard and horny, and has a bitterish somewhat aromatic taste, and camphoraceous odour.

Zarawand-i-tawil (*Pers., Ind. Bazars*). The imported root of *Aristolochia longa*, Linn., *Mill. Ic.*, *t.* 51, *f.* 2, a plant much resembling *A. rotunda*, and having a similar habitat. It differs from the latter plant in having petioled leaves, yellow flowers striped with brown, and a cylindrical root which has much the same taste and odour as that of *A. rotunda.* Mahometan

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physicians describe it as resolvent, deobstruent, diuretic, emmenagogue, alexipharmic, and vermifuge.*

These Aristolochias were formerly considered to be antidotes for snake-bites. Albertus Magnus (*De mirabilibus Mundi*) says:—"Si vis statim interficere serpentem, accipe ex Aristolochia rotunda quantum vis et tere illam bene, et accipe ranam sylvestrem vel campestrem et contere ipsam et commisce eam Aristolochia, et pone cum eo aliquid ex incausto, et scribe cum eo in charta aut aliquo quod plus amas, et projice ad serpentes."

Zaráwand-i-gird, or mudahraj, is considered by Persian writers on Materia Medica to be the female of *Aristolochia longa*. Mír Muhammad Husain tells us that at Ispahan it is called Nukhud-i-alwandi. Mahometan physicians describe it as resolvent, stimulating, pectoral, stomachic, and cephalic; they prescribe it in jaundice and gout. True Zaráwand-i-gird is very scarce in India; most of the druggists, when asked for it, supply the small starchy, inert tuber of an arum.†

The Aristolochias are still collected by herbalists in Southern Europe for medicinal use.

PIPERACEÆ.

PIPER NIGRUM, *Linn.*

Fig.—*Miq. Ill. Pip.* 50, *t.* 50; *Bot. Mag.*, *t.* 3139; *Bentl. and. Trim.*, *t.* 245; Black Pepper (*Eng.*), Poivre noir (*Fr.*).

Hab.—Travancore and Malabar. Cultivated elsewhere. The fruit.

Vernacular.—Mirach, Káli-mirach (*Hind.*), Gol-marich (*Beng.*), Milagu (*Tam.*), Miriyálu (*Tel.*), Kuru-mulaka (*Mal.*), Menasu (*Can.*), Miri, Káli-miri (*Mar.*), Kalo-miri (*Guz.*). White

* Compare with the description of the two Aristolochias in Dioscorides (iii., 4) περὶ αριστολοχίας στρογγύλης. Pliny mentions their use by women to procure male offspring, and Apuleius recommends them as a protective against the evil eye.

† *Pinellia tuberifera*, Tenore, the *Sang-pwan-hea* of the Chinese, growing about Pekin (*Hance, Linn. Journ. Bot.*, xiii. (1872), 88), figured and described by Hanbury. (*Science Papers*, p. 262.)

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pepper bears the same names with the addition or substitution of the adjective "white."

History, Uses, &c.—The earliest travellers from the West who visited India, found the pepper vine in cultivation on the Malabar Coast. Theophrastus (H. P. ix., 22) mentions two kinds of pepper (πίπερι or πέπερι) in the fourth century B. C., and Dioscorides (ii., 148) mentions λευκον πέπερι, white pepper, μακρόν πέπερι, long pepper, and μέλαν πέπερι, black pepper. Pliny says:—"It is quite surprising that the use of pepper has come so much into fashion, seeing that in other substances which we use, it is sometimes their sweetness, and sometimes their appearance, that has attracted our notice; whereas, pepper has nothing in it that can plead as a recommendation to either fruit or berry, its only desirable quality being a certain pungency; and yet it is for this that we import it all the way from India! Who was the first to make trial of it as an article of food? and who, I wonder, was the man that was not content to prepare himself, by hunger only, for the satisfying of a greedy appetite?" (12, 14.)

In the Periplus of the Erythrean Sea, written about A.D. 64, it is stated that pepper is exported from Baraké, the shipping place of Nelkunda. in which region, and there only, it grows in great quantity. These have been identified with places on the Malabar Coast between Mangalore and Calicut.

Long pepper and Black pepper are among the Indian spices on which the Romans levied duty at Alexandria about A.D. 176.

Cosmas Indicopleustes, a merchant, and in later life a monk, who wrote about A.D. 540, appears to have visited the Malabar Coast, or at all events had some information about the pepper-plant from an eye-witness. It is he who furnishes the first particulars about it, stating that it is a climbing plant, sticking close to high trees like a vine. Its native country he calls *Male*. The Arabian authors of the Middle Ages, as Ibn Khurdádbah (*circa* A.D. 869-885), Edrisi in the middle of the 12th, and Ibn Batuta in the 14th century, furnished nearly similar accounts.

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Among Europeans who described the pepper-plant with some exactness, one of the first was Benjamin of Tudela, who visited the Malabar Coast in A.D. 1166. Another was the Catalan friar, Jordanus, about 1330; he described the plant as something like ivy, climbing trees and forming fruit, like that of the wild vine. "This fruit," he says, "is at first green, then, when it comes to maturity, black." Nearly the same statements are repeated by Nicolo Conti, a Venetian, who, at the beginning of the 15th century, spent twenty-five years in the East. He observed the plant in Sumatra, and also described it as resembling ivy. (*Pharmacographia.*)

The high cost of pepper contributed to incite the Portuguese to seek for a sea passage to India, and the trade in this spice continued to be a monopoly of the Crown of Portugal as late as the 18th century.

In January 1793, an agreement was made between the Rajah of Travancore and the English, by which he was to supply a large quantity of pepper to the Bombay Government in return for arms, ammunition and European goods; this was known as the "Pepper Contract."

It is worthy of remark that all the foreign names for black pepper are derived from Pippali, the Sanskrit name for long pepper, which leads one to suppose that the latter spice was the first kind of pepper known to the ancient Persians and Arabs, through whose hands it first reached Europe. Their earlier writers describe the plant as a shrub like the Pomegranate (*P. chaba ?*). The moderns apply the name Filfil (Pilpil, *Pers.*) to all kinds of pepper. Black pepper is called in Sanskrit Maricha, which means a "pungent berry." The word is derived from Marichi, "a particle of light or fire," and appears to have been first applied to the aromatic berries known as Kakkola; it now signifies black and red pepper, and in the vernacular forms of Mirach or Mirchai, is a household word in India.

Maricha is described in the Nighantas as bitter, pungent, digestive, hot and dry; synonyms for it are Valli-ja "creeper grown," Ushana, Tikshna "pungent," Malina, Syama "black," &c. It is said to be useful in intermittent fever, hæmorrhoids,

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dyspepsia, cough, gonorrhœa and flatulence, and to promote the secretion of bile. Together with long pepper and ginger it forms the much-used compound known as Trikatu, "the three acrids," or "Ushana-chatu-rushana." Externally, pepper is used as a rubefacient and stimulant of the skin. In obstinate intermittent fever and flatulent dyspepsia, the Hindus administer white or black pepper in the following manner:—A tablespoonful is boiled overnight in one seer of water, until the water is reduced to one-fourth of its bulk, the decoction is allowed to cool during the night, and is taken in the morning. The pepper is then again boiled in the same manner and the decoction taken at night. This treatment is continued for seven successive days. A compound confection of pepper (*Prúnada gudiká*) is given as a remedy for piles; it is made in the following manner:—Take of black pepper 32 tolas, ginger 24 tolas, long pepper 16 tolas, *Piper chaba* (chavya) 8 tolas, leaves of *Taxus baccata* (tálisa) 8 tolas, flowers of *Mesua ferrea* (nágkesar) 4 tolas, long pepper root 16 tolas, cinnamon leaves and cinnamon one tola each, cardamoms and the root of *Andropogon muricatus* (usira) 2 tolas each, old treacle 240 tolas; rub them together. Dose about 2 drachms. When there is costiveness, chebulic myrobalans are substituted for ginger in the above prescription. (*Chakradatta.*)

The use of pepper for the cure of intermittents is strongly recommended by Stephanus in his commentary on Galen, and recently some cases of refractory intermittent fever, in which, after the failure of quinine, piperine has been administered with advantage, are reported by Dr. C. S. Taylor (*Brit. Med. Journ.*, Sept., 1886). In one case, immediately on the accession of an attack, three grains of piperine were given every hour, until eighteen grains had been taken, and on the following day, when the intermission was complete, the same dose was given every three hours.

Mahometan physicians describe black pepper as deobstruent, resolvent, and alexipharmic; as a nervine tonic it is given internally, and applied externally in paralytic affections; in toothache it is used as a mouth-wash. As a tonic and digestive, it is given in dyspepsia. With vinegar it forms a good

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stimulating poultice. With honey it is useful in coughs and colds. Moreover, it is diuretic and emmenagogue, and a good stimulant in cases of bites by venomous reptiles. Strong friction with pepper, onions, and salt is said to make the hair grow again upon the bald patches left by ringworm of the scalp. They notice the use of the unripe fruit, preserved in salt and water as a pickle, by the natives of Malabar.

De Gubernatis draws attention to the following passage from the travels of Vincenzo Maria da Santa Caterina (iv., 3) with reference to white pepper being offered by the Hindus to their gods in Malabar:—"Da Malavari è tenuto in stima grandissima, eli Gentili d'ordinario l'offrono a 'loro Dei, si per la rarità come per la virtù salutifera e medicinale, che da quello sperimentano, riportandolo poi alli infermi." For the early history of pepper in Europe, the *Pharmacographia* may be consulted.

Cultivation.—Its cultivation is very simple, and is effected by cuttings or suckers put down before the commencement of the rains in June. The soil should be rich, but if too much moisture be allowed to accumulate near the roots, the young plants are apt to rot. In three years the vine begins to bear. They are planted chiefly in hilly districts, but thrive well enough in the low country in the moist climate of Malabar. They are usually planted at the base of trees which have rough or prickly bark, such as the jack, the erythrina, cashewnut, mango-tree, and others of similar description. They will climb about 20 or 30 feet, but are purposely kept lower than that. During their growth it is requisite to remove all suckers, and the vine should be pruned, thinned, and kept clean of weeds. After the berries have been gathered, they are dried on mats in the sun, turning from red to black. They must be plucked before they are quite ripe, and if too early they will spoil. White pepper is the same fruit freed from its outer skin, the ripe berries being macerated in water for the purpose. In this latter state they are smaller, of greyish-white colour, and have a less aromatic or pungent taste. The pepper-vine is very common in the hilly districts of Travancore, especially in the Cottayam, Meenachel, and Chenganacherry districts, where, at an average calculation,

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about 5,000 candies are produced annually. It is a Government monopoly. (*Drury.*)

Description.—The immature fruit, known as Black Pepper, is globular, about $\frac{1}{5}$ of an inch in diameter, much wrinkled, and of a brown-black colour; on one side are the remains of the peduncle, and on the other of the style and stigmas. The pericarp is closely adherent to the seed. The latter consists of a thin reddish-brown testa and a copious albumen, the exterior portion of which is horny and the interior farinaceous. The embryo is undeveloped. The mature seed, known as White Pepper, is less acrid than Black, as the pericarp has been removed; it is also rather smaller and of a grey colour, striated from base to apex by about a dozen light stripes.

The transverse section of a grain of black pepper exhibits a soft, yellowish epidermis covering the outer pericarp. This is formed of a closely-packed yellow layer of large, mostly radially arranged, thick-walled cells, each containing in its small cavity a mass of dark-brown resin. The middle layer of the pericarp consists of soft, tangentially-extended parenchyme, containing an abundance of extremely small starch granules and drops of oil. The shrinking of this loose middle layer is the chief cause of the deep wrinkles on the surface of the berry. The next inner layer of the pericarp exhibits towards its circumference, tangentially-arranged soft parenchyme, the cells of which possess either spiral striation or spiral fibres, but towards the interior, loose parenchyme free from starch and containing very large oil cells.

The testa is formed in the first place of a row of small yellow thick-walled cells. Next to them follows the true testa, as a dense, dark-brown layer of lignified cells, the individual outlines of which are undistinguishable.

The albumen of the seed consists of angular, radially arranged, large-celled parenchyme. Most of its cells are colourless and loaded with starch; others contain a soft, yellow, amorphous mass. If thin slices are kept under glycerine for some time,

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these masses are slowly transformed into needle-shaped crystals of piperin. (*Pharmacographia.*)

Chemical composition.—Black pepper contains an acrid resin, a volatile oil, starch, gum, a small quantity of fatty oil in the mesocarp, and about 5 per cent. of inorganic matter, besides the alkaloid *piperine*, and a volatile alkaloid which is probably identical with *piperidine*. The acrid resin is dark-green, soluble in alcohol, ether and alkalies, and, in connection with other constituents of pepper, also in water. C. Heisch (*Analyst*, xi, 186-190) has shown that pepper should contain not less than 50 per cent. of starch, which is characterised by the smallness of its granules. The essential oil has been examined by L. A. Eberhardt (*Archiv. d. Pharm.* (3), XXV., 515-519); it had a sp. gr. of 0·87352 at 15° C., and showed a greenish colour, due neither to chlorophyll nor to copper. At 22° the oil had a lævorotatory power of 3·2° in a column 100 mm. long. On rectification a very small quantity passed over at 160°. Fractions obtained at 170°, 176° and 180° were colourless; that obtained at 190° faint green, and that at 250° green, that passing over at 310° brown-green. Above 310° a brown, tenacious residue was obtained in which phenol could not be detected. The 170° fraction, when rectified under reduced pressure, gave a terpene boiling at 164°—165°, and showed a left-handed rotation of 7·6° in 100 mm.; it gave numbers agreeing with the formula $C^{10}H^{16}$.

The composition of the other fractions was much the same as this. The oil consists of a lævorotatory terpene and isomeric compounds of higher boiling point. (*Journ. Chem. Soc.*, Oct., 1887; *Year-Book Pharm.*, 1888.)

Pure piperine crystallizes in colourless flat, four-sided prisms of a glassy lustre and almost tasteless. As usually met with, it is of a yellowish colour, inodorous, and has at first a slight, but on continued mastication, or in alcoholic solution, a sharp, peppery taste. It remains unaltered on exposure, has a neutral reaction to test-paper, is nearly insoluble in water, and dissolves in volatile oils, in 60 parts of cold ether (*Merck*), in 30 parts of cold

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and in 1 part of boiling 80 per cent. alcohol (*Wittstein*), and freely in acetic acid; the last two solutions are precipitated on the addition of water. It is likewise soluble in chloroform, benzol, and benzin. At 129° C. it melts like wax to a yellowish oily liquid, which on cooling congeals to a mass of resinous appearance; when fused it may be ignited, and burns with a bright flame, leaving a light charcoal, which is readily consumed by heating it in the air. Sulphuric acid colours it blood-red, the colour disappearing on the addition of water, leaving the piperine unaltered if the action of the acid has not been prolonged (*Pelletier*). The solution of piperine in sulphuric acid is yellow, becoming dark-brown, and finally green-brown (*Dragendorff*). Nitric acid colours piperine successively greenish-yellow, orange, and red, and dissolves it with a yellow colour, the solution separating yellow floccules on the addition of water; by prolonging the action of the acid, oxalic acid and a yellow bitter compound are produced (*Pelletier*). The resin resulting from this reaction becomes blood-red on the addition of potassa, and on heating the mixture piperidine is given off (*Anderson*, 1850). Piperine is a very weak base, and its salts are decomposed by water; crystallizable double salts, soluble in alcohol, may be obtained with the chlorides of mercury, platinum, and cadmium. By dry distillation with soda-lime piperidine is obtained. Boiled with alcoholic solution of potassa, piperine was found by Babo and Keller (1856) to be resolved into *piperic acid*, $C^{12}H^{10}O^{4}$, and *piperidine*, $C^{5}H^{11}N$. Piperic acid is in hair-like, yellowish, needles which fuse at 150° C., and at a higher temperature volatilize partly unaltered, at the same time giving off a coumarin-like odour. Piperidine is a colourless liquid of an ammoniacal and pepper-like odour, and when largely diluted of a bitter taste. It boils at 106° C., has a strong alkaline reaction, dissolves freely in water and alcohol, and yields with acids crystallizable salts; the piperate of piperidine crystallizes in silky scales, which, on being heated, give off a part of the alkaloid. Ladenburg (1884) obtained a small quantity of piperidine synthetically by treating an alcoholic solution of pyridine with sodium. (*National Dispensatory.*) Heisch

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(*Analyst*, 1886) gives the following analysis of pure and commercial peppers :—

	Water.	Total ash.	Ash soluble in water.	Ash soluble in acid.	Insoluble ash.	Alkalinity as K^2o.	Starch.	Alcoholic extract.	Piperin.
Black berry ...	9·22 to 14·36	4·35 to 8·93	1·54 to 3·34	1·51 to 3·83	·36 to 4·38	·72 to 1·57	48·53 to 56·67	10·47 to 16·2	4·05 to 9·38
White berry ...	13·67 to 17·32	1·28 to 8·78	·217 to ·618	·84 to 2·80	·22 to ·69	... ·22	76·27 to 77·68	9·23 to 9·73	5·13 to 6·14
Fine ground white	13·90	1·58	·16	·9	·52	...	75·31	10·66	4·51
Long pepper	12·15	13·48	2·28	5·52	5·68	·53	58·78	8·29	1·71
Adulterated ground	11·12	14·7	2·02	4·07	8·61	·78	35·85	11·57	2·03

W. Johnstone (*Chem. News*, Nov., 1889) has shown that pepper contains a volatile alkaloid probably identical with piperidine. Black pepper yielded 0·56 per cent., and the husks alone 0·74 per cent., of this base. White pepper yielded it also, but in smaller quantity, and the larger proportion of piperidine in the husk, the author considers to be an explanation of the greater pungency of black pepper as compared with white pepper. Long pepper was found to yield 0·34 per cent. of the alkaloid. (*Year-Book Pharm.*, 1889.)

Commerce.—The exports of pepper from the Malabar Coast for the past 6 years have been—

	Cwts.
1884-85	91,516
1885-86	100,804
1886-87	106,976
1887-88	136,605
1888-89	101,177
1889-90	141,257

The Travancore State exports annually about 3,000 candies of pepper, each candy containing 500 English lbs., and this brings to the State an annual income of 6 lakhs of rupees.

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Adulteration.—As pepper is always sold whole in India, it is seldom adulterated. We have occasionally met with an admixture of the berries of *Embelia Ribes*, and the fruit of *Mirabilis Jalapa* is stated to be sometimes mixed with it.

The abortive berries of **P. troicium,** *Roxb.*, now considered to be the wild form of *P. nigrum*, are known in Western India as Pokali-miri, and the plant as Kokervel in Marathi and Murial-tiga in Telugu. Garcia d' Orta notices the drug under the name of Canarese pepper, and observes that it never finds its way to Portugal, but is valued as a medicine by the natives to purge the brain of phlegm, to relieve toothache, and as a remedy for cholera.

This plant was first described by Roxburgh, who found it growing wild in the hills north of Samulcotta.

It was growing plentifully about every valley among the hills, delighting in a moist rich soil, and well shaded by trees; the flowers appearing in September and October, and the berries ripening in March. Roxburgh commenced a large plantation, and in 1789 it contained about 40,000 or 50,000 pepper-vines, occupying about 50 acres of land. The produce was great, about 1,000 vines yielding from 500 to 1,000 lbs. of berries. He discovered that the pepper of the female vines did not ripen properly, but dropped while green, and that when dried it had not the pungency of the common pepper; whereas the pepper of those plants which had the hermaphrodite and female flowers mixed on the same ament was exceedingly pungent, and was reckoned by the merchants equal to the best Malabar pepper.

Pliny (12,14) mentions abortive pepper seeds known by the name of "Bregma," a word which in the Indian language signifies "dead." He remarks that it is the most pungent kind of pepper.

Lendi-pipali. Globular catkins of a species of pepper occasionally found in the Bombay market, said to come from Singapore. They are of the size of the pellets of sheep's dung, hence the name Lendí-pípalí. The taste is very hot and acrid.

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The individual fruits are nearly as large as cardamom seeds, the whole catkin having much the appearance of a small blackberry.

PIPER CHABA, *Hunter.*

Fig.—*Miq. Ill. Pip., t.* 34; *Hayne, Arnz., Gewachs. xiv., t.* 21; *Wight Ic., t.* 1927. Long Pepper (*Eng.*), Poivre long (*Fr.*).

Hab.—Cultivated in India and the Malay Islands. The fruit and stem.

Vernacular.—Chẚb (*Hind.*), Chai (*Beng.*), Chavak (*Mar.*).

PIPER LONGUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 244; *Miq. Ill. Pip., t.* 30; *Hayne, Arnz. Gewachs. xiv., t.* 20; *Wight Ic., t.* 1928; *Rheede, Hort. Mal. vii., t.* 14.

Hab.—Hotter provinces of India. The fruit and root.

Vernacular.—The fruit.—Pipal, Pippali (*Hind.*), Tippili (*Tam.*), Pippallu (*Tel.*), Tippali (*Mal.*), Yippali (*Can.*), Pipul (*Beng.*), Bangáli-pipali (*Mar.*), Pipara (*Guz.*). The root.—Pippali-múl, Pipla-múl, Pipla-mur (*Hind.*), Tippili-mulam, Tippili-vér (*Tam.*), Modi, Pippali-katta (*Tel.*), Tippili-vér (*Mal.*), Pipuli-múl (*Beng.*), Pipali-múl (*Mar., Guz.*).

History, Uses, &c.—As we have already stated, we think it highly probable that long pepper was the kind of pepper first known to the ancient inhabitants of Western Asia and Europe. (See *P. nigrum.*) In Sanskrit works on medicine, *P. longum* is described under the name of Pippali, and bears the synonyms of Chapalá, Pála, Mágadhi "growing in South Bihar," Kaná, Shaundi, &c. It is considered to be digestive, sweet, cold, bitter, emollient and light; useful in rheumatism, asthma, cough, abdominal enlargements, fever, leprosy, gonorrhœa, piles and spleen. Old long pepper is to be preferred to fresh. A mixture of long pepper, long pepper root, black pepper and ginger in

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equal parts, is prescribed by several writers as a useful combination for catarrh and hoarseness. As an alterative tonic, long pepper is recommended for use in a peculiar manner. An infusion of three long peppers is to be taken with honey on the first day, then for ten successive days the dose is to be increased by three peppers every day, so that on the tenth day the patient will take thirty at one dose. Then the dose is to be gradually reduced by three daily, and finally the medicine is to be omitted. Thus administered, it is said to act as a valuable alterative tonic in paraplegia, chronic cough, enlargements of the spleen and other abdominal viscera. Long pepper and black pepper enter into the composition of several irritating snuffs; boiled with ginger, mustard oil, buttermilk and curds it forms a liniment used in sciatica and paralysis. In the Concan the roasted aments are beaten up with honey and given in rheumatism; they are also given powdered with black pepper and rock salt (two parts of long pepper, three of black, and one of salt) in half tolá doses for colic. Mahometan writers, under the name of Dárfilfil, describe long pepper as a resolvent of cold humours; they say it removes obstructions of the liver and spleen, and promotes digestion by its tonic properties; moreover, it is aphrodisiacal, diuretic, and emmenagogue. Both it and the root (Filfil-muiyeh) are much prescribed in palsy, gout, lumbago, and other diseases of a similar nature. A collyrium of long pepper is recommended for night blindness; made into a liniment it is applied to the bites of venomous reptiles. We learn from Roxburgh (*Flora Indica*, I., p. 155) "that it is in Bengal only that *Piper longum* is cultivated for its pepper. When the ament is full-grown, it is gathered and daily exposed to the sun till perfectly dry; after which it is packed in bags for sale. The roots and thickest part of the creeping stems, when cut into small pieces and dried, form a considerable article of commerce all over India, under the name of Pippali-mula, for which purpose it is particularly cultivated in many of the valleys amongst the Sircar mountains. This sort is more esteemed, and bears a higher price than that of Bengal, where by far the largest

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portion is cultivated. It, as well as the pepper, is chiefly employed medicinally, and the consumption of both these drugs is very great." *Piper longum* was formerly cultivated at Poway, near Bombay; it appears to grow well in gardens in Bombay, but requires plenty of manure.

Pippali-mula, with the synonyms Kana-mula, Katu-granthi, Ushana-granthika, Chataka and Chataka-shira, is described in the Nighantas as having the same properties as long pepper. *P. Chaba*, which produces the long pepper of European commerce, is the Chavi, Chavika and Chavya of Sanskrit writers. It is considered to have the same properties as *P. longum*. The aments are sold in the bazars as Mothi pippali, and the stem as Cháb, Chai or Chavak.

The oblong black pepper of Theophrastus (H. P., ix., 22) was probably long pepper. Dioscorides, in his article upon the three peppers, mentions a pepper root, and says it resembles Costus, has a hot taste, and causes salivation when chewed. This drug was probably Galangal, which is known as Pán-ki-jar or root of *Piper Betle*, because its odour somewhat resembles that of Betle leaves.

Description.—The ament of *P. Chaba*, the long pepper of European commerce, consists of a multitude of minute baccate fruits, closely packed round a common axis, the whole forming a spike 1½ inch long and ¼ inch thick. The spike is supported on a stalk ½ an inch long; it is rounded above and below, and tapers slightly towards its upper end. The fruits are ovoid, $\frac{1}{10}$ of an inch long, crowned with a nipple-like point (stigma), and arranged spirally with a small peltate bract beneath each. Beneath the pericarp, the thin brown testa encloses a colourless albumen, of which the obtuser end is occupied by the small embryo. The colour of commercial long pepper is greyish-white, as if it had been rolled in some earthy powder. When washed the spikes are reddish-brown. The drug has a burning aromatic taste, and an agreeable odour.

The ament of *P. longum* has a similar structure, but is shorter, more slender and less pungent. When fresh it has hardly any

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aroma, but in the process of drying it gradually developes an aromatic taste and odour.

Pippali-mula, or pepper root, when fresh, is a fleshy, crooked, and knotted root about the size of a goose-quill, with many smaller rootlets branching from it. The cortical portion is very thick, and covered by a thin smooth brown epidermis. The central woody column is soft and divided into from 4 to 6 wedge-shaped portions by from 4 to 6 very conspicuous medullary rays.

Microscopic structure.—The epidermis of the root consists of several rows of tangentially extended brown cells. The parenchyme of the cortex is chiefly composed of large thin-walled cells loaded with starch, and containing drops of essential oil. Amongst them are scattered cells containing a refractive yellow substance (resin). The central woody column is also loaded with starch, and contains as many resin-cells as the cortex. The medullary rays are abundantly provided with large scalariform vessels.

Chemical composition.—The constituents of long pepper are the same as those of black pepper.

A third kind of long pepper is met with in the bazars, which is known as Swaheli or Sugandhi-pippali, and is imported from Zanzibar. It has a peculiarly fragrant odour, and is administered with honey as a remedy for cough; it has not the acridity of the other long peppers.

The aments are from 1 to 2½ inches in length, flexuose, many of them barren or nearly so, only one or two fruits having come to maturity. These aments are almost filiform. The peduncle is about one inch long. The mature fruit after being soaked in water is $\frac{1}{12}$ inch in diameter, pyriform, mucronate (the *mucro* bifurcated), sessile; it consists of a pulpy envelope enclosing a somewhat pyriform seed resembling in structure that of other peppers.

Commerce.—Three kinds of long pepper are met with in the Indian market—1*st*, Singapore, which is identical with the long pepper of European commerce; 2*nd*, Bangáli, the produce of *P. longum*, cultivated in Bengal; 3*rd*, Swaheli, imported from Zanzibar.

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Value, Singapore, Rs. 7 to Rs. 12 per maund of 41 lbs.; Bengal, Rs. 9; Zanzibar, Rs. 5. Pippali-mul is also of three kinds: Mirzapore, Rs. 10 to Rs. 40; Bengal, Rs. 7 to Rs. 7½; Malwa, Rs. 50 per maund of 41 lbs.

PIPER CUBEBA, *Linn. f.*

Fig.—*Bentl. and Trim.*, *t.* 243. Cubebs (*Eng.*), Cubèbes (*Fr.*)

Hab.—Java. The fruit.

Vernacular.—Kabáb-chini, Kankol (*Hind.*), Kankola (*Mar.*), Vál-milaku (*Tam.*), Toka-miriyalu, Chalava-miriyalu (*Tel.*), Vál-mulaka (*Mal.*), Bála-menasu (*Can.*), Chini-kabáb (*Guz.*).

History, Uses, &c.—Cubebs were introduced into medicine by the Arabian physicians of the Middle Ages. Masudi in the 10th century stated them to be a production of Java. The author of the *Sihah*, who died in 1006, describes Kabábeh as a certain medicine of China. Ibn Sina, about the same time, notices it as having the properties of madder, but a more agreeable taste, and states that it is said to possess hot and cold properties, but is really hot and dry in the third degree, a good deobstruent, and useful as an application to putrid sores and pustules in the mouth; it is also good for the voice and for hepatic obstructions; a valuable diuretic, expelling gravel and stone from the kidneys and bladder. He concludes by stating that the application of the saliva, after chewing it, increases the sexual orgasm. Later Mahometan writers have similar accounts of Kabábeh, and say that it is called Hab-el-arús, "bridegroom's berry," and that Greek names for it are Mahilyun (μάχλόν?), and Karfiyun, evidently a corruption of καρπήσιον, the name of an aromatic wood mentioned by Paulus Ægineta. It appears that cubebs were at one time known as *Fructus carpesiorum* in Europe. In the Rája Nirghanta, which was written about 600 years ago, cubebs appear under the name of Kankola, and the same name appears in the Hindi and Marathi Nighantas. Madanpal gives Katuka-kola, "pungent pepper," as a synonym for it. All the Sanskrit names appear to be of comparatively recent origin. The authors of the *Pharmacographia* draw

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attention to the fact that the action of cubebs upon the urino-genital organs, though known to the old Arabian physicians, was unknown to modern European writers on Materia Medica at the commencement of the present century. According to Crawfurd, its importation into Europe, which had long been discontinued, recommenced in 1815, in consequence of its medicinal virtues having been brought to the knowledge of the English medical officers serving in Java, by their Hindu servants. (*Op. cit.*, *2nd Ed.*, p. 585.) In earlier times cubeb pepper was used in Europe as a spice, as it still is, to some extent, in the East.

Description.—The fruits are elevated on a kind of stalk, formed from the contraction of the base of the fruit itself, so that they are not really but only apparently stalked.

The dry berries are spherical, wrinkled, of a brown colour, and are easily distinguished from black pepper by the pedicel at their base; beneath the pericarp is a nut which contains the seed. The albumen is white and oily. As the fruit is gathered when immature, the drug usually consists of little else than the pericarp. The mature fruit which is sometimes met with in the Indian Bazars should be rejected.

Microscopic structure.—The pericarp consists of an epidermis, beneath which is an interrupted row of small thick-walled cells. Within this the parenchyme is composed of cells containing starch and oil; in the latter, bundles of needle-shaped crystals of cubebin may be observed; lastly, the innermost layer of the pericarp is formed by several rows of tangentially extended cells containing essential oil. The nut is yellow and brittle. The seed when present is seen to contain crystals of cubebin.

Chemical composition.—The most obvious constituent of cubebs is the volatile oil, the proportion of which yielded by the drug varies from 4 to 13 per cent. The oil, when freshly distilled, is slightly greenish, but becomes colourless on rectification. It has the odour of cubebs, and a warm aromatic comphoraceous taste. Its density varies between 920 and 936 at 15° C. The causes of the great variation in the yield of oil may be found in

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the constitution of the drug itself, as well as in the alterability of the oil, and the fact that its prevailing constituents do not begin to boil below 264° C. Cubeb oil was shown by Oglialoro to be a mixture of a turpene boiling at 158° to 163°, which is present to a very small amount, and two oils of the formula $C^{15}H^{24}$, boiling at 262° to 265° C. One of the latter deviates the plane of polarization strongly to the left, and yields a crystalline compound, $C^{15}H^{26}Cl^{2}$, melting at 118° C. The other hydrocarbon is less lævogyrate, and does not combine with HCl. (*Deut. Chem. Ges. Ber.*, viii., 1357.) Cubeb oil mixes with glacial acetic acid in all proportions; iodine gives a violet coloration without perceptible reaction; with nitric acid it becomes opaque, and on heating a pale red tint is afforded. (*Braunt.*) One part of oil, diluted with about 20 parts of bisulphide of carbon, assumes at first a greenish, and afterwards a blue coloration, if one drop of a mixture of equal weights of concentrated sulphuric and nitric acids is shaken with the solution. The oil distilled from old cubebs, on cooling after a time, is stated to deposit large, transparent, inodorous octohedra of *camphor of cubebs*, $C^{30}H^{48}+2OH^{2}$, belonging to the rhombic system, which melt at 65°, and sublime at 148°. But the authors of *Pharmacographia* failed to obtain crystals after keeping the oil of fresh cubebs for two years in contact with water, to which a little nitric acid had been added.

Another constituent of cubebs is *Cubebin*, crystals of which may sometimes be seen in the pericarp even with a common lens. It was discovered by Soubeiran and Capitaine in 1839; it is an inodorous substance, crystallizing in small needles or scales, melting at 125°, having a bitter taste in alcoholic solution. It dissolves freely in boiling alcohol, but is mostly deposited upon cooling; it requires 30 parts of cold ether for solution, and is also abundantly soluble in chloroform. Flückiger and Hanbury found this solution to be slightly lævogyre, and to turn red on addition of concentrated sulphuric acid. If the solution of cubebin in chloroform is shaken with phosphoric anhydride, it turns *blue*, and gradually becomes red on absorption of

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moisture. Cubebin is nearly insoluble in cold, but slightly soluble in hot water. Bernatzik (1866) obtained from cubebs 0·40 per cent. of cubebin, Schmidt (1870) 2·5 per cent. The crystals, which are deposited in an alcoholic or ethereal extract of cubebs, consist of impure cubebin. Cubebin is devoid of any remarkable therapeutic action; its composition, according to Weidel (1877), answers to the formula $C^{10}H^{10}O^{3}$; by melting it with caustic potash, it is resolved into acetic and protocatechuic acids.

The resin extracted from cubebs consists of an indifferent portion nearly 3 per cent., and of *Cubebic Acid*, amounting to about 1 per cent. of the drug. Both are amorphous, according to Schmidt, like the salts of cubebic acid. Bernatzik, however, found some, as the barium salt, to be crystallizable. Schulze (1873) prepared cubebic acid from the crystallized sodium-salt, but was unable to obtain it crystalline. The resins, the indifferent as well as the acid, possess the therapeutic properties of the drug. Schmidt further pointed out the presence in cubebs of gum (8 per cent.), fatty oil, and malates of magnesium and calcium. The yield of ash, according to Warnecke, is 5·45 per cent.

Commerce.—Bombay is supplied with the drug from Singapore. There is a good demand for it, and the consumption in native practice appears to be increasing. Value—Formerly cubebs was obtainable in the Indian markets at from 4 to 5 annas per lb., but for the last eight years the price has been seldom less than Re. 1 per lb.

PIPER BETLE, *Linn.*

Fig.—*Wight Ic., t.* 2926; *Miq. Ill. Pip., t.* 39; *Bot. Mag., t.* 3132; *Rheede, Hort. Mal. vii., t.* 15. Betle Pepper (*Eng.*), Poivrier de Betel (*Fr.*).

Hab.—Cultivated in the hotter parts of India, Ceylon, and Malay Islands. The leaves.

Vernacular.—Pán (*Hind., Beng., Guz., Mar.*), Vettilai (*Tam.*), Nága-valli (*Tel.*), Vetrila (*Mal.*), Viledele (*Can.*).

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History, Uses, &c.—According to the Hitopadesa, the Betle-leaf (támbúla) has thirteen properties (Támbúlasya trayodasha gunáh svarge'pi te durlabháh). It is sour, bitter, heating, sweet, salt, astringent; it expels flatulence (vataghna), phlegm (kaphanàsana), worms (krimihara); it removes bad odours; beautifies the mouth, cleans it, and excites voluptuous sensations. According to Hindu tradition, the plant (Nága-valli) was brought from heaven by Arjuna, who stole a branch of it, which he planted on his return to earth. The leaves with Betle-nut and spices form the *vira*, or *pán-súpári*, so much used by the natives of India as a token of civility or affection. It is also given in confirmation of a pledge, promise, or betrothal, and, among the Rajpoots, is sometimes exchanged as a challenge; thus the expression *bira uthana* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dalna*, "to propose a premium" for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "Vetalapanchavinshati," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree, nourishing himself with a smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pan ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not án easy matter.

The betle-leaf was probably the Malabathron or Indian leaf of the Greeks, sometimes called simply "leaf" (φυλλόν), and sold in rolls in a dried state. Dioscorides speaks of its being threaded on strings to dry, a practice which, before the introduction of steam carriage by sea, was common in Bombay among the Indian traders who sent the leaves to their friends at foreign ports. The passage in Dioscorides ἐν τω μελανίζειν τε ἄθραυστον καὶ

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ὁλόκληρον is probably corrupt, and should be as suggested by his commentator, M. Vergilius, ἐν τω μαλακίζειν τε ἄθραυστον καὶ ὁλοκληρον, a reading which he found in one manuscript. As regards the fabulous growth of Malabathron as recorded by Dioscorides, it may possibly have originated from a confused account of the method of ripening betle leaves followed in some parts of India. The author of the *Makhzan* states that the leaves, which, when plucked, are always green, are packed in a large kind of basket and covered with rice or wheat straw. A hole is then dug in the ground, of the size of the basket, and a fire lighted in it until the ground becomes warm. The fire is then removed, and the basket of leaves is placed in the hole and covered with stones or any heavy weight so as to press the leaves together; it is kept in this position for 24 hours, and after removal the basket is exposed to the night dew, if it is the hot season, or kept in a warm place, if it is the cold season, until the leaves are of a pale yellow colour and become brittle. That Malabathron was not a cinnamon leaf, is, we think, clear from Dioscorides in his chapter on Cassia, describing its leaves as like those of the pepper plant, thus showing that he was acquainted with cinnamon leaves as distinct from Malabathron.

Ibn Sina describes Támbúl as cold and dry, astringent and desiccative, and notices its use by the Hindus. The author of the *Makhzan-el-Adwiya*, who wrote in India, gives a full account of the different varieties of Betle-leaf produced by cultivation; of the method of ripening the leaves for the market; and of their properties and uses.

Dutt (*Hind. Mat. Med.*, p. 244) has the following concise account of their uses:—"The leaves of this creeper are, as is well known, masticated by the natives of India. The poorer classes make their packet of betle with the addition of lime, catechu, and betle-nuts. The rich add cardamoms, nutmegs, cloves, camphor, and other aromatics; betle-leaf thus chewed acts as a gentle stimulant and exhilarant. Those accustomed to its use feel a sense of langour when deprived of it. The ancient Hindu writers recommend that betle-leaf should be taken early in the morning, after meals and at bed-time. According to

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Susruta, it is aromatic, carminative, stimulant, and astringent. It sweetens the breath, improves the voice, and removes all foulness from the mouth. According to other writers it acts as an aphrodisiac. Medicinally it is said to be useful in diseases supposed to be caused by deranged phlegm, and its juice is much used as an adjunct to pills administered in these diseases, the pills being rubbed into an emulsion with the juice of the betle-leaf and licked up. Being always at hand, *Pán* leaves are used as a domestic remedy in various ways. The stalk of the leaf smeared with oil is introduced into the rectum in constipation and tympanitis of children, with the object of inducing the bowels to act. The leaves are applied to the temples in headache for relieving pain, to painful and swollen glands for promoting absorption, and to the mammary gland with the object of checking the secretion of milk. *Pán* leaves are used as a ready dressing for foul ulcers, which seem to improve under them."

The spittle, after chewing *pán súpári*, is red, and is freely ejected by natives, preferably over recently white-washed walls; the dry stains are often mistaken by the police for blood stains, and pieces of plaster, leaves, grass, &c., thus stained have frequently been forwarded to the Chemical Examiner, Bengal, for detection of blood!

Of late years the medicinal properties of betle leaves have been investigated in Europe. Dr. Kleinstuck of Zwatzen, near Jena, has found that the essential oil is of much use in catarrhal affections, inflammations of the throat, larynx and bronchi; it has an antiseptic action. He has also used it in diphtheria as a gargle and by inhalation. The dose is one drop in one hundred grams of water. In India the juice of four leaves may be used similarly diluted.

Cultivation.—The betle garden (*pán-mala*) is a work of art. The best site is the well-drained alluvial bank of a river or stream. The vine is rather fond of an iron soil, but lime, salt, or soda are fatal to it. The well must last throughout the year, be perfectly sweet, and not more than forty feet deep, otherwise the cost of

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raising the water eats up the greater part of the profits. The betle-leaf, it is said, cannot be grown from channel water, which is very cold. After the site has been chosen, the next point is to fence it from cattle, thieves, and strong winds. First is an outer line (*kumpan*) of substantial wicker-work, split bamboos, Zizyphus twigs, or other pliable material. Inside of this fence is a thick milk-bush hedge.* Then comes a belt of the large castor plant, and last of all, a row of plantains. The garden is laid out in an invarying pattern. The whole, crosed by water channels and roads, forms beds of different shapes and sizes. Each bed, known by a particular name, such as the *cheritang*, the *bertang*, and the *váfa*, is stocked with a certain number of vines, so that the outturn and other particulars of a garden can be calculated with great nicety. After the ground has been laid out and properly levelled, tree seeds are sown for the vines to train on. Round the edge of each bed is a line of *shevri* (*Sesbania ægyptiaca*), and in the centre from two to three feet apart, the seeds of *hadga* (*Sesbania grandiflora*) and *pangára* (*Erythrina indica*), and from four to six feet apart, single seeds of the *nimb* (*Melia Azadirachta*), are planted. In addition to these, the *popai* (*Carica Papaya*), singly, and plantains in pairs are dotted about, according to the amount of shade required. These seeds are sown in the first week in June (*mriga nakshatra*), and after that, hand-weeding and watering every eight days is all that is wanted up to the end of December (*pushya nakshatra*), when the nurse-trees are eighteen inches to two feet high, or large enough for planting the vines. From the tops of the best ripened shoots, in the old plantations, seven-inch cuttings are taken. They are first made into small bundles, wrapped in plantain leaves, soaked in the water they have been accustomed to, carried to the new plantation, soaked in the new water, and all but the tips buried in the ground. For some time water is given daily; later on once in two days; and afterwards, except during the hot months when it is given every other day, once in six days. From each unburied tip a shoot springs. When they are a few inches long, the shoots are led up the stems of the

* Euphorbia neriifolia.

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nurse-trees, and lightly tied with strips of a dried sedge (*path*), so elastic that, without untying it, the pressure of the growing vine keeps it loose. When the vine has grown to the proper height, it is turned back and trained down until it reaches the ground, where it is layered in the earth and again turned up. This is repeated until the tree-stem is fully clothed with vines, when the whole is firmly tied with the dried reeds of the *lavála** grass. After this the management of the plantation closely resembles the cultivation of the grape vine in Southern Europe. Leaf-picking may be begun eighteen months after planting, but in the best gardens it is put off till the end of the second year. The leaves may be gathered green and ripened artificially, or they may be left to ripen on the vine, though this reduces their value. The leaf-picker uses both hands, the thumbs sheathed in sharp-edged thimble-like plates, which nip the leaves clean off without wrenching the plant. The vine-grower is either himself a leaf-dealer, or he sells his crop in bulk to a leaf-dealer. Their table of measures is: 400 leaves make a *kavli*; 44 *kavlis* a *kurtan*; and four *kurtans* or 70,400 leaves an *ojhe*. In retail the leaves are sold at from 1—2 annas the hundred. (*Khandesh Gazetteer*, p. 174.)

Description.—The leaves are about five inches long, broadly ovate, acuminate, obliquely cordate at the base, 5 to 7 nerved, coriaceous, and glossy on the upper surface: they have a burning, aromatic and bitter taste.

Chemical composition.—D. S. Kemp of Bombay (1885), by distilling the fresh leaves with water, obtained two pale yellow essential oils, one heavy and the other light, both having the peculiar odour of the leaf, but the light oil being more aromatic. These oils oxidised rapidly, losing their characteristic ethereal odour. The heavy oil was freely soluble in alcohol and ether, sparingly so in chloroform. It had a specific gravity of 1·046 at 84° F., and was slightly lævogyre, (a) j = —·54 for a column 100 mm. long. Prof. J. F. Eijkman's results with oil of betle,

* *Scirpus subulatus*, Vahl., and *Cyperus pertenuis*, Roxb., are both known by this name.

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distilled by himself from fresh leaves, which had been in part reported in 1888, have been communicated to the German Chemical Society (*Berichte*, 1889, pp. 2736–2754). The oil was pale greenish-yellow, became golden-yellow and brown on exposure, was slightly lævogyre, and had the sp. gr. 0·969 at 15° C. Caustic potash removed from the oil *chavicol*, a phenol of sp. gr. 1·030 at 15°C., boiling between 236° and 238° C., and having a peculiar odour, somewhat resembling that of creasote; its composition is $C^9H^{10}O$; its aqueous solution is coloured blue by ferric chloride, the colour disappearing on the addition of alcohol; its constitution is expressed by the formula

$$C^6H^4\begin{cases} OH\ (1) \\ C^3H^5\ (3). \end{cases}$$

The crude chavicol seems to contain a small quantity of a phenol of somewhat higher boiling point, and in alcoholic solution becoming blue with ferric chloride. Betle oil, freed from phenol, did not yield, on fractional distillation, a pure compound in sufficient quantity for examination. The fraction between 173° and 176° contained several terpenes, but no pinene, and had a very agreeable lemon-like odour, while a mint-like odour was observed in the fraction between 190° and 220°. From the higher boiling fraction a hydrocarbon, sesquiterpene, was obtained, having a slight odour, boiling at 260° C., and in acetic solution acquiring a deep indigo-blue colour with bromine. Eijkman calls attention to the betle oil obtained by Schimmel & Co. from dried leaves, and shows that the oil did not contain the above compounds to which the fresh leaves owe their characteristic odour, and which must have been dissipated by drying, or oxidised by exposure, or lost by remaining dissolved in the water; the use of steam under pressure may have volatilized more of the high-boiling phenol than is obtainable by ordinary distillation.

The oil distilled from the dry leaves by Messrs. Schimmel & Co. was a slightly brown-coloured liquid, sp. gr. 1024 at 15°C. It consisted up to about $\frac{2}{3}$ or $\frac{3}{4}$ of a phenol, the boiling point of which in partial vacuum, under a pressure of 12 mm., lay at 131°—132° C.; under ordinary atmospheric pressure it

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underwent decomposition on boiling. The sp. gr. of the phenol was 1·067 at 15° C. Examination of the oxidation products, acetyl compound and methyl ether, showed that this compound was not eugenol, but an isomer, the composition of the new compound (iso-eugenol) and of eugenol being represented as follows:—

Iso-eugenol.	Eugenol.
$C^6H^3\begin{cases} C^3H^4 & (1) \\ OH & (3) \\ OC\,H^3 & (4) \end{cases}$	$C^6H^4\begin{cases} C^3H^5 & (1) \\ OCH & (3) \\ OH & (4) \end{cases}$

The second constituent of the oil boiled practically between 250° and 275° C., had a very agreeable tea-like odour, and consisted for the greater part of a sesquiterpene $C^{15}H^{24}$, cubebene, which is characterized by its dihydrochlorate melting at 117°—118° C. (*Berichte von Schimmel & Co.*, 1887.)

At the Narturforscher Meeting in 1888, Professor Eijkman reported that among the constituents of the essential oil distilled from fresh betle leaves, he had found a characteristic compound, having the odour of the leaves and the constitution of parallyl-phenol, which he designated "*chavicol.*" About the same time Messrs. Schimmel announced that the phenol present in the higher-boiling factions of the oil distilled from air-dried betle leaves corresponded completely with eugenol, though subsequently they made the modified statement that the phenol obtained by them was not eugenol, but an isomer (*Pharm. Journ.* [3], xix., 803.) With a view to clearing up the apparent contradiction, Prof. Eijkman has re-examined the oil distilled by himself from the fresh leaves, and some distilled from dry leaves by Messrs. Schimmel, with the result of confirming the presence in the former of chavicol, boiling at 236° to 238° C., and in the latter of the isomer of eugenol, boiling at 254° to 255°, which proved to be orthomethoxychavicol (*Berichte*, xxii., 2735). It would seem probable, therefore, that both phenols occur in the leaves, and that chavicol being the more volatile, had practically disappeared from the dried leaves, while the method of distillation adopted by Messrs. Schimmel favoured the more complete

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removal of the higher-boiling compound. Some experiments made with chavicol are said to have shown it to be a powerful antiseptic, it being five times stronger as a bacteriacide than carbolic acid, and twice as strong as eugenol. (*Pharm. Journ.*, Nov. 30th, 1889.)

A sample of oil distilled from fresh betel leaves in Manila, at the request of Messrs. Schimmel, is described as of a golden yellow colour, possessing a pronounced odour of betelphenol and having a specific gravity of 1·044 at 15° C. The phenol was separated from the oil by the method of Bertram and Gildemeister, and during the purification by distillation at a pressure of 11 mm. it passed over quite regularly between 128° and 129°, a behaviour that pointed to a homogeneous body. By treatment of the phenol with benzoyl chloride a benzoyl compound was obtained that crystallized in scales and melted at 50°. It was evident that this was not a mixture of benzoyl compounds, as the portion that crystallized first had the same melting-point as that which crystallized last; it followed, therefore, that it represented no other phenol than betelphenol. Other constituents occur in this oil only in a small quantity, and of these, to judge from the boiling point, terpenes form only a small fraction. The results of the examination of betel oil up to the present time may therefore be summed up as follows:—

(1) Oil distilled from fresh leaves from Java (Eijkman), contained besides terpenes and other bodies, chavicol and betelphenol.

(2) Oil from dried Siam leaves consisted of sesquiterpene and betelphenol.

(3) Oil distilled from fresh leaves (Java) contained terpenes, betelphenol and a small quantity of another phenol (probably chavicol), the nature of which could not be determined, from want of material (melting point of the benzoyl compound 72°-73°).

(4) Oil from fresh leaves distilled in Manila contained no other phenol than betelphenol.

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Betelphenol was contained in all the oils, whether derived from Java, Siam or Manila, or from fresh or dry leaves; it would therefore appear to be a characteristic constituent of betle oil. (*Berichte v. Schimmel & Co.*, Oct. 1891.)

MYRISTICEÆ.

MYRISTICA FRAGRANS, *Houtt.*

Fig.—*Bentl. and Trim.*, *t.* 218; *Reichb. Ic. Exot.*, *t.* 276-277; *Nees, Pl. Med.*, *t.* 133; *Rumph. Herb. Amb.*, *ii.*, *t.* 4. Nutmeg (*Eng.*), Muscade (*Fr.*), Mace (*Eng.*), Macis (*Fr.*).

Hab.—Moluccas. Cultivated in Penang, Malay Island, and Zanzibar. The seeds and arillus.

Vernacular.—Nutmegs—Jaiphal (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Jádikai (*Tam.*), Jaji-kaya (*Tel.*), Jájikayi (*Can.*), Játikka (*Mal.*). Mace—Javitri, Jápatri (*Hind.*), Jádipattiri (*Tam.*), Jápatri (*Can.*, *Tel.*), Játipattiri (*Mal.*), Jotri (*Beng.*), Jáyapatri (*Mar.*), Javantari, Jápatri (*Guz.*).

History, Uses, &c.—Natmegs, in Sanskrit Játi and Játiphala, are mentioned by Susruta, and in the Nighantas bear various synonyms, such as Játi-kosha, Játi-sára, Shálúka, and Majja-sára; they are considered to be hot, digestive, carminative, expectorant and anthelmintic. Mace is called Játi-pattri, and is said to have similar properties. Both of these spices probably became known in India through the Hindu colonists in Java and the Eastern Islands. From India they would appear to have reached Persia and Eastern Europe. The authors of the *Pharmacographia* remark that nutmegs were probably known at Constantinople about the year 540. The Arabs evidently first became acquainted with nutmegs through the Persians, as their name Jouz-bawwa is a corruption of the Persian Gauz-i-buya, "fragrant nut." Masudi, who travelled in the East in A.D. 916—920, discovered that they were obtained

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from the Zerbád Islands. Ibn Sina describes both nutmegs and mace (Basbáseh). Edrisi, who wrote in the middle of the 12th century, mentions both nutmegs and mace (Basbáseh) as articles of import into Aden. By the end of the 12th century both of these spices were well known in Continental Europe.

Mir Muhummad Husain says that the Dutch keep the trade in their own hands, but that he has heard that the tree is now cultivated in Sounda in Southern India. Whether he was rightly informed with regard to Sounda, we are unable to say. But that his information was substantially correct, there can be no doubt, as Ainslie tells us that in his time the true nutmeg tree was growing in the Tinnevelly District, and produced pretty good fruit. The tree has also been introduced into Ceylon and Zanzibar, and appears to flourish in the warm moist climates of those islands.

Mahometan doctors describe nutmegs and mace as stimulating, narcotic, digestive, tonic, and aphrodisiac, useful in choleraic diarrhœa, especially when roasted; also in obstructions of the liver and spleen. A paste made with nutmegs is used as an external application in nervous headache, palsy, &c.; applied round the eyes it is thought to strengthen the sight. The expressed oil of nutmegs is imported into India from Banda, and is known as Jawitri-ka-tel (oil of mace). It was formerly exclusively brought into European commerce *viâ* Holland, in oblong cakes having nearly the form of common bricks, but somewhat smaller, and packed in monocotyledonous leaves, commonly called "flag leaves." At the present time much of the oil is manufactured in Europe, and put up in the same shape, but packed in paper. When discoloured and hardened by age, the oil is called "*Banda soap.*" Oil of mace is manufactured by exposing imperfect and broken nutmegs, reduced to a paste and enclosed in a bag, to steam, and then pressing the bag between heated iron plates. The yield is about 20 to 23 per cent. (*Brannt.*) The bark of the tree is astringent. (*Pereira, Mat. Med.*, ii., p. 475.) We have found nutmegs and their

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essential oil a valuable adjunct to other drugs in the treatment of diarrhœa and dysentery; they appear to relieve the pain.

Description.—The following excellent description of the nutmeg fruit is taken from the *Pharmacographia* :—" The fruit of *Myristica fragrans* is a pendulous, globose drupe, about 2 inches in diameter, and not unlike a small round pear. It is marked by a furrow which passes round it, and by which at maturity its thick fleshy pericarp splits into two pieces, exhibiting in its interior a single seed, enveloped in a fleshy foliaceous mantle or arillus, of fine crimson hue, which is mace. The dark-brown, shining ovate seed is marked with impressions corresponding to the lobes of the arillus; and on one side, which is of paler hue and slightly flattened, a line indicating the raphe may be observed.

The bony testa does not find its way into European commerce, the so-called nutmeg being merely the kernel or nucleus of the seed. Nutmegs exhibit nearly the form of their outer shell, with a corresponding diminution in size. The London dealers esteem them in proportion to their size, the largest, which are about one inch long by $\frac{8}{10}$ of an inch broad, and four of which will weigh an ounce, fetching the highest price. If not dressed with lime, they are of a greyish-brown, smooth yet coarsely furrowed and veined longitudinally, marked on the flatter side with a shallow groove. A transverse section shows that the inner seed coat (endopleura) penetrates into the albumen in long, narrow brown strips, reaching the centre of the seed, thereby imparting the peculiar marbled appearance familiar in a cut nutmeg. At the base of the albumen, and close to the hilum, is the embryo, formed of a short radicle with cup-shaped cotyledons, whose slit and curled edges penetrate into the albumen. The tissue of the seed can be cut with equal facility in any direction. It is extremely oily, and has a delicious aromatic fragrance, with a spicy rather acrid taste." The expressed oil of nutmeg is of the consistence of tallow, but more friable, orange-coloured, and of a fragrant, spicy taste and odour. It has a sp. gr. of ·990 (*Brannt*).

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Microscopic structure.—The brown covering of the nutmeg is formed by the endopleura, which also dips in and forms numerous processes which divide the albumen in every direction; it is composed of soft-walled brown cells, which on the external surface are small and flat, but much larger in the processes already mentioned. The cell-structure of the albumen is loaded with starch and fatty matter, some of which is crystalline.

Herr A. Tschirch states that the aril of *Myristica fragrans* furnishes a good illustration of the presence of amylodextrin as a normal cell-content in the place of starch. It is distinguished from true starch by being stained reddish-brown instead of blue by an aqueous solution of iodine. The grains of amylodextrin are from 2 to 10 μ in diameter, and do not appear to contain even a nucleus of starch. They have usually somewhat the form of a rod, and are often curved or coiled; less often they are roundish or disc-shaped; they do not usually exhibit any evident stratification.

Chemical composition.—Nutmegs contain from 2 to 8 per cent. of volatile oil, 25 to 30 per cent. of fat, starch, protein compounds, &c. The most volatile portion of the oil, after treatment with sodium, was found, by Cloëz, to be a lævogyre hydrocarbon, $C^{10}H^{16}$, having the odour of the nut, and boiling at 165° C. It is the *myristicene* of Gladstone, who named the oxygenated portion *myristicol*, $C^{10}H^{14}O$; this is dextrogyre, boils at 224° C., and does not, like menthol and carvol, yield a crystalline compound with H^2S. The *nutmeg camphor* of John, or *myristicin* of Gmelin, which separates sometimes on standing, was ascertained by Flückiger to be myristic acid. From the expressed oil of nutmeg or nutmeg butter, cold alcohol dissolves about 6 per cent. of volatile oil and 24 per cent. of fat, accompanied by brown-yellow resinous matter, which has not been further examined. The remaining pulverulent white fat is *myristin*, $C^3H^5(C^{14}H^{27}O^2)^3$, which crystallizes from hot alcohol or ether and fuses at 31°C. Heintz found the melting-point of *myristic acid* to be 53·8°C. Schmidt and Rœmer found 3 to 4 per cent. of free myristic acid, with a little stearic acid.

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The most important constituent of mace is the volatile oil which is present to the amount of about 8 per cent., but occasionally as much as 17 per cent. may be obtained. (*Pharmacographia.*) Schacht found it to consist mainly of a terpene, $C^{10}H^{16}$, called *macene*, which yields a crystallizable compound with hydrochloric acid gas, and appears to be related to, but, by Koller, considered identical with, the myristicene of oil of nutmeg. The oxygenated portion of the volatile oil is still less known than the terpene. Henry found red fat soluble, and yellow fat insoluble, in alcohol, but the 24·5 per cent. residue obtained by Flückiger (*Pharmacographia*) with boiling ether and drying at 100° C. appeared to have consisted solely of resin and semi-resinified volatile oil. The same author obtained with alcohol 1 04 per cent. of uncrystallizable sugar, and with hot water 1·8 per cent. of a body which turned blue, and after drying reddish-violet, with iodine, and is probably intermediate between starch and mucilage. (*National Disp.*) J. Semmler (*Berichte*, 23, 1803) has isolated, by fractional distillation from mace or rather nutmeg oil, a body possessing the peculiar odour of mace, which he calls *myristicin*, and which has the composition represented by $C^{12}H^{14}O^{3}$. The correctness of the formula was controlled by the preparation of a bromine derivative dibrom-myristicin, $C^{12}H^{12}Br^{2}O^{3}$, which melts at 105° C.

According to Warnecke, powdered nutmegs yield 41·25 per cent. of fat when boiled for two hours in a reflux condenser with benzol, and the dried residual powder gives 3·77 per cent. of ash. Mace yields 1·39 per cent. of ash, and after removal of 30·13 per cent. of fat, 2·74 per cent.

Toxicology.—The narcotic effects of nutmegs noticed by the old Mahometan physicians have been confirmed by Bontius, Rumphius, Lobel, Schmid and Cullen, and more recent experiments upon man and animals agree in showing that they have a narcotic and intoxicating action. In a case related by Cullen, two drachms of powdered nutmegs produced drowsiness, which gradually increased to complete stupor and insensibility. The patient continued for several hours alternately delirious and sleeping, but ultimately recovered.

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Commerce.—Value, Re. 1-4-0 to Re. 1-8-0 per lb. The nutmegs imported into India run from 100 to 130 to the pound; the larger seeds never make their appearance in this market. Indeed the native retail dealers prefer small seeds, as they buy by weight and sell by number.

MYRISTICA MALABARICA, *Lamk.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 269; *Rheede, Hort. Mal.* iv., *t.* 5.

Hab.—Concan, Canara, N. Malabar. The seed and arillus.

Vernacular.—Rán-jaiphal, Rámphal (*Mar.*), Panam-palka (*Mal.*). The Mace—Rámpatri (*Mar.*, *Guz.*).

History, Uses, &c.—This drug does not appear to have been known to the older Hindu and Mahometan medical writers, but the following extract from the *Makhzan-el-Adwiya* seems to apply to it. Speaking of true nutmegs, the author says:—'Latterly the English have discovered a kind of nutmeg in Southern India, which is longer than the true nutmeg and softer, but is much inferior to it in oiliness, odour, and medicinal properties." (*Makhzan*, article "*Jouz-bawwa.*")

It is the *Nux myristica mas* of Clusius, and the *Panam-palca* of Rheede, who says that the Turkish and Jewish merchants use the nutmegs and mace for adulteration. Rumphius (i.,185) notices it under the name of *Mannetjes-nooten*, and states that it is used by the Javanese and Malays as a remedy for headache and as an aphrodisiac, and is worn round the neck as a protection from boils. It is also used by the Indians in Amboyna, combined with opium and roasted unripe plantains, in dysentery.

According to the editor of the *Pharmacopœia of India*, the seed is used medicinally in the Madras Presidency; it yields, when bruised and subjected to boiling, a considerable quantity of concrete oil, analogous to expressed oil of nutmeg, which is said to be an efficacious application to indolent ulcers, allaying pain and establishing healthy action. An ointment may be made by melting it with sweet oil. The seeds are used for similar purposes in Bombay in the form of a *lép*, and the oil is also extracted.

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Recently, the arillus, under the name of '*Bombay mace*,' has made its appearance in the European markets, for the purpose of adulterating true mace. (Confer. *A. Tschirch in Pharmaceut. Zeitung*, 1881, No. 74.) In Bombay it is used as a spice.

Description.—*M. malabarica* bears an oblong, tawny, hairy fruit, 2½ to 3 inches long, with a lucumose arillus, the lobes of which are twisted and folded into a cone at the top, and are longer and thinner than those of true mace. The arillus is of a dark brownish-red colour, and on the inside has adhering to it a thin papery membrance of a light-brown colour. The shell is hard and brittle, and contains an elongated kernel resembling a nutmeg, and from 1¼ to 2 inches long; when cut in two it is seen to have the same ruminated structure, but the odour is fruity, with hardly any aroma. Similarly, the mace is deficient in odour and flavour.

Microscopic structure.—The epidermal cells of the arillus are radially elongated, narrow, and twice as high as those of true mace, which are tangentially elongated; their walls show the cellulose reaction with iodine and sulphuric acid, and with chloride of zinc and iodine swell and turn faintly blue. The oil cells are very numerous, located near the epidermis on both sides, often close together in groups of two or three, oval in shape, somewhat radially elongated, and contain a dark-yellow, usually, resinified oil, frequently also a brownish resin. (*A. Tschirch.*) The external covering of the seed is formed by the compressed cells of the endopleura, and is thicker than that of the true nutmeg; the processes which penetrate the albumen are composed of very large cells loaded with a viscid reddish-brown substance, which has an astringent and somewhat acid taste. The albumen is composed of large cells loaded with starch; some of the cells and their contents are of a reddish-brown colour. There is no crystalline fat visible.

Toxicology.—Rumphius relates that in 1683 a minister of Amboyna was given by his wife three roasted nuts, in mistake for nutmegs, to cure a chronic diarrhœa; in a few hours he became giddy, making strange gestures and talking wildly, nor

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did he get any relief until he had taken several cups of tea and been blooded. He then slept profoundly and perspired very freely. On waking, no bad effects remained, and the diarrhœa had ceased. Rumphius remarks that if he had taken three real nutmegs, he would have suffered much more.

Commerce.—Rámpatri is now worth about Rs. 10 per maund of 37½ lbs.; formerly it was much cheaper. The nutmegs fetch Rs. 2 per maund of 37½ lbs. According to Dr. Hefelmann, the adulteration of powdered mace in Germany generally consists in the addition of Bombay mace, or of other vegetable material (leguminous fruits) coloured with turmeric. The presence of the latter is shown by the presence of starch cells which are not present in mace. Bombay mace may be detected by boiling the suspected sample with alcohol and filtering through a white filter; in the case of pure mace, the filter is stained a faint yellow, but in the presence of Bombay mace, the filter, especially the edge, is coloured red. Another more delicate test is to add Goulard's extract to the alcoholic filtrate; with pure mace only a white turbidity is occasioned, but when Bombay mace is present, a red turbidity is obtained. The reaction given by turmeric is similar, but it may be distinguished from that of Bombay mace in the following manner:—A strip of filter paper is saturated with the alcoholic solution, the excess of fluid removed, and the strip drawn through a cold saturated solution of boric acid; when Bombay mace is present, the paper remains unchanged, but in the presence of turmeric it turns orange-brown. If a drop of potassium hydrate solution is now placed on the strip of paper, it causes a blue ring if turmeric is present, and a red ring if the adulterant is Bombay mace.—(*Pharm. Zeit.*, 1891, 122.)

LAURINEÆ.

CINNAMOMUM CAMPHORA, *Nees.*

Fig.—*Bentl. and Trim.*, *t.* 222; *Woodv. Med. Bot.*, *t.* 236; *Nees*, *t.* 130; *Berg. et Sch.*, *t.* 10, *e.*; *Wight Ic.*, *t.* 1818. Camphor (*Eng.*), Camphre (*Fr.*).

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Hab.—China, Japan. Camphor and Oil of Camphor.

Vernacular.—Káfúr (*Hind.*), Karppúram, Shúdan (*Tam.*), Karpúram (*Tel.*, *Mal.*), Karpura (*Can.*), Kápúr, Káphúr (*Beng.*), Kápúr (*Mar.*, *Guz.*).

History, Uses, &c.—As has been already mentioned (see article "Dryobalanops"), Sanskrit writers, under the name of Karpura, speak of two kinds of camphor, Pakva and Apakva. It is generally supposed that the former term, which means prepared by the aid of heat, refers to ordinary commercial camphor obtained from the wood of *C. Camphora*. The researches of Flückiger and Hanbury show that the only camphor known in early times was that found in the trunk of *Dryobalanops aromatica*. Early Chinese writers only speak of *C. Camphora* as producing a valuable wood, and we have no information as to the date of the first extraction of camphor from it. Garcia d'Orta, who wrote at Goa about the middle of the sixteen century, was well acquainted with both kinds of camphor, and mentions that the China camphor is the only kind exported to Europe. The medicinal uses to which camphor is put in the East have been already noticed under "Dryobalanops." With the exception of a small quantity of refined camphor imported from Japan, the bulk of the drug used in India is imported in the raw state and resublimed in the country. The process of resublimation is a peculiar one, the object being to get as much interstitial water as possible into the camphor cake. The vessel used is a tinned cylindrical copper drum, one end of which is removable; into this is put 14 parts of crude camphor and 2½ parts of water; the cover is then luted with clay, and the drum being placed upon a small furnace made of clay, is also luted to the top of the furnace. In Bombay four of these furnaces are built together, so that the tops form a square platform. The sublimation is completed in about three hours; during the process the drums are constantly irrigated with cold water. Upon opening them a thin cake of camphor is found lining the sides and top; it is at once removed and thrown into cold water. Camphor sublimed in this way is not stored, but

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distributed at once to the shopkeepers before it has time to lose weight by drying. It is sold at the same price as the crude article, the refiner's profit being derived from the introduction of water. Experiments by Clautrian (*Berichte*, xxiv., 2612) have proved that camphor possesses considerable hygroscopic properties which are not shared by thymol. 40 grains of camphor will absorb ·054 gram of water from air saturated with aqueous vapour at 16°C. The absorption of moisture by camphor would appear to be a purely physical phenomenon. Both China and Japan crude camphor is imported into Bombay, but the latter is preferred, as it is cleaner. From Japan is also imported refined camphor in large square cakes an inch and a half thick, with a hole in the centre; it is nearly equal in quality to that refined in Europe. The method of obtaining crude camphor in Japan will be found fully described by H. Oishi in the *Journ. Soc. Chem Ind.*, 1884, p. 353. Camphor is largely used in India in performing the *árti* (आरती), a ceremony performed in adoration of some god by waving, in a circle before the image, a platter containing a five-wicked burning lamp, flour, and incense; the lamp being fed with camphor. The same rite, only substituting a bridegroom for the idol, is called *árta*, and is performed on the arrival of the bridegroom at the house of the bride. In Sanskrit this light is called आरात्रिक (árátrika).

Description.—Crude China camphor is in small dirty-white or brown grains, more or less moist from the presence of water; it arrives in tin-lined boxes which hold one quintal. Crude Japan camphor is also in grains, which often adhere together in masses; it is dry and often quite free from discoloration; sometimes it has a pinkish tinge. It is imported in double butts.

Refined Japan camphor is imported in tin-lined cases, which hold about 90 lbs. Bombay refined camphor is in porous cakes a quarter of an inch thick, and contains much water. Owing to the method of preparation already described, the cakes have no particular form.

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Chemical composition.—Camphor, $C^{10}H^{16}O$, by treatment with various reagents, yields a number of interesting products: thus, when repeatedly distilled with chloride of zinc or anhydrous phosphoric acid, it is converted into *Cymene* or *Cymol*, $C^{10}H^{14}$, a body contained in many essential oils, or obtainable therefrom. Camphor, and also camphor oil, when subjected to powerful oxidising agents, absorbs oxygen, passing gradually into crystallized *Camphoric acid*, $C^{10}H^{16}O^4$ or $C^8H^{14}(COOH)^2$, water and carbonic acid being at the same time eliminated. Many essential oils, resins, and gum-resins likewise yield these acids when similarly treated. By means of less energetic oxidizers, camphor may be converted into *Oxy-camphor*, $C^{10}H^{16}O^2$, still retaining its original odour and taste. (*Pharmacographia.*) For a full account of the reactions of camphor and its derivatives, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., Vol. I., p. 669. The constituents of camphor oil found up to the present are:—

Boiling point.	Constituent.	Formula.
158°—162°	Pinene.	$C^{10}H^{16}$
170°	Phellandrene.	$C^{10}H^{16}$
176°	Cineol.	$C^{10}H^{18}O$
180°	Dipentine.	$C^{10}H^{16}$
204°	Camphor.	$C^{10}H^{16}O$
215°—218°	Terpineol.	$C^{10}H^{17}OH$
232°	Safrol.	$C^{10}H^{10}O^2$
248°	Eugenol.	$C^{10}H^{12}O^2$
274°	Sesquiterpene.	$C^{15}H^{24}$

Toxicology.—Instances of poisoning by camphor are rare, and, as far as we are aware, no cases have been reported on by Chemical Examiners in India. In large doses camphor causes excitement and delirium with dilated pupils and sometimes convulsions. The mucous membrane of the stomach may be inflamed, but characteristic lesions appear to be absent.

Commerce.—The crude camphor of commerce is largely manufactured in Central China, Formosa, and Japan, and is exported

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from Canton in chests lined with lead or tinned iron weighing about 1 cwt. each, and from the Japan ports in double tubs which contain about the same quantity. The imports into India have an average annual value of seven lacs of rupees. Refined camphor from Europe now forms an important item in these imports, and some years ago refined camphor was also imported from Japan, but lately it has disappeared from the market. The price of camphor in India is now regulated by the European market, and of late has been extremely variable.

CINNAMOMUM CASSIA, *Blume.*

Fig.—*Bentl. and Trim., t.* 223. China cinnamon, Cassia (*Eng.*), Cannelle de Chine (*Fr.*).

Hab.—China. The bark and essential oil.

Vernacular.—Dárchiní (*Hind.*), Dalchini (*Beng., Mar., Guz.*), Lavanga-pattai (*Tam., Tel., Mal.*), Lavanga-patte (*Can.*).

History, Uses, &c.—Cinnamon and Cassia are mentioned as precious odoriferous substances in the Mosaic writings and by Theophrastus and many other writers of antiquity. The Greek names κινναμώμον and κασία or κασσία are derived from the Phœnician, and are the same as those used by the Hebrews. From Galen we learn that these two spices were of a similar nature, but that cassia was inferior to cinnamon. It is impossible to say for certain what these substances were, but it seems probable that κινναμώμον was Chinese cassia, and κασια the bark of the Indian cinnamon trees. Dioscorides describes several varieties of cinnamon and cassia, and we know that several very distinct varieties of Cinnamon bark are still sold in Indian bazars. That Ceylon cinnamon was not known to the ancients appears to be certain, as the sacred books and old records of Ceylon make no mention of that spice, and when the bark began to be collected in the island is unknown. Kazwini in the 13th century is the first writer who mentions it, and it was not cultivated before 1770.

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Cassia, under the name of *Kwei*, is mentioned in the earliest Chinese herbal, said to have been written 2700 B.C., and also in the Chinese classics. In the *Hei-yao-pen-tsao*, written in the 8th century, mention is made of *Tien-chu-kwei*. Tien-chu is the ancient name for India. (*Pharmacographia.*)

The bark of several species of cinnamon growing in different parts of India was known to the ancient Hindus as Tvach, "bark," Guda-tvach, "sweet," or "sugar bark," and the trees producing it as Tvak-sára, "having excellent bark," and Tvaksvádvi, "having sweet-bark." The aboriginal tribes still scrape the bark from these trees and use it to season their food, and have probably done so from prehistoric times.

The Arabians, through whose hands most of the cinnamon of the ancients reached Europe, called the spice Kirfat-ed-dársini, or more shortly Kirfah (the bark *par excellence*), and it is curious to observe that the same word in the corrupted form of Kalfah is still the commercial name of Malabar cassia in Bombay. Dársini is the Arabic form of the Persian Dárchini, and signifies "China tree," *dár* being an old Persian name for a tree; it is therefore probable that the Arabs first obtained the spice from the Persians by the overland route from China. The same name is still current in India for Chinese cinnamon, whereas the Indian bark is properly called *Taj*, a word derived from the Sanskrit *Tvach*, although in popular language Dalchini and Taj are loosely applied to any kind of cinnamon. Ibn Sina follows Dioscorides in his description of the different kinds of cinnamon (*dársini*) and cassia (*salikheh*), but later Mahometan writers are better informed, and are evidently well acquainted with the difference between Ceylon cinnamon, China cassia, and Indian cassia. Haji Zein (1368), speaking of Dárchini, says "the best is that which comes from Ceylon"; concerning Salikheh, he says:—"It is what they call cassia (قشيا), and is the bark of a tree called *Salkh*; there are several qualities, the best is of a reddish colour, thick, and a little bitter to the taste, astringent; when broken it has a fracture like China rhubarb, it is in long

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folded sticks with a small central hollow like *kirfah*; that which is dark-coloured is bad." Of Kirfah he says, "it has not the sweetness of China cinnamon, and tastes like cloves." In Southern India cassia is called "clove-bark" in several of the vernaculars.

The author of the *Makhzan* remarks:—"From Ceylon to the Dekhan the quality of the cinnamon grown gradually deteriorates, the bark getting thick and mucilaginous."

For the history of cinnamon and cassia in Europe, we would refer our readers to the *Pharmacographia*, where much interesting information will be found.

Cassia and cassia oil imported from China are used medicinally in India in much the the same manner as they are in Europe. Ceylon cinnamon is not an article of commerce in India.

Description.—Chinese cassia arrives in Bombay packed in boxes, which are covered with matting. Each box contains about 60 lbs. The bark is tied up in bundles with strips of bamboo, which weigh about 1 lb. each. The greater portion of each bundle consists of single quills of a light-brown colour, with here and there portions of the external bark still attached; in the centre of the bundle is small collection of fragments of bark and rubbish. Cassia bark is thicker than true cinnamon, but has a similar taste and odour.

Microscopic structure.—Externally the bark is furnished with a suberous layer. Within this is a parenchymatous portion in which may be seen an irregular zone of stony cells. The remainder is mostly composed of liber, in which are situated numerous large cells which contain the essential oil. Laticiferous vessels containing a gummy substance are also present in the parenchyme.

Chinese cassia oil is imported in tins, which contain 12½ catties each; it has a similar odour and colour to oil of cinnamon, but is less agreeable.

Chemical composition.—The authors of the *Pharmacographia* remark: "Cassia bark owes its aromatic properties to an

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essential oil, large quantities of which are shipped from Canton. In a chemical point of view, no difference can be pointed out between this oil and that of Ceylon cinnamon. The flavour of cassia oil is somewhat less agreeable, and, as it exists in the less valuable sorts of cassia, decidedly different in aroma from that of cinnamon. We find the sp. gr. of a Chinese cassia oil to be 1·066, and its rotatory power in a column 50 mm. long, only 0·1° to the right, differing consequently in this respect from that of cinnamon oil.

"If thin sections of cassia bark are moistened with a dilute solution of perchloride of iron, the contents of the parenchymatous part of the whole tissue assume a dingy brown colour; in the outer layers the starch granules even are coloured. Tannic matter is consequently one of the chief constituents of the bark; the very cell-walls are also imbued with it. A decoction of the bark is turned blackish-green by a per salt of iron.

"If cassia bark (or Ceylon cinnamon) is exhausted by cold water, the clear liquid becomes turbid on addition of iodine; the same occurs if a concentrated solution of iodide of potassium is added. An abundant precipitate is produced by addition of iodine dissolved in the potassium salt. The colour of iodine then disappears. There is consequently a substance present, which unites with iodine; and, in fact, if to a decoction of cassia or cinnamon, the said solution of iodine is added, it strikes a bright blue coloration, due to starch. But the colour quickly disappears, and becomes permanent only after much of the test has been added. We have not ascertained the nature of the substance that thus modifies the action of iodine; it can hardly be tannic matter, as we have found the reaction to be the same when we used the bark that had been previously repeatedly treated with spirit of wine and then several times with boiling ether.

"The mucilage contained in the gum-cells of the thinner quills of cassia is easily dissolved by cold water, and may be precipitated together with tannin, by neutral acetate of lead, but not by alcohol. In the thicker barks it appears less soluble, merely swelling into a slimy jelly."

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Oil of cassia, like oil of cinnamon, consists chiefly of *Cinnamic aldehyde,* $C^6H^5(CH)^2COH$, together with a variable proportion of hydrocarbons. The oil easily absorbs oxygen, becoming thereby contaminated with resin and cinnamic acid, $C^6H^5(CH)^2COOH$. In a sample examined by Messrs. Schimmel, the cinnamic aldehyde amounted to 77·7 per cent., the distillation residue to 5·5 per cent., and the cinnamic acid to 0·7 per cent. After one year's free exposure to light, warmth, and air, the percentage of cinnamic acid in this oil had increased to 8·5, and of distillation residue to 12·6, whilst the cinnamic aldehyde had decreased to 68·5, showing that the most important change in the oil is the conversion of cinnamic aldehyde into cinnamic acid, and a slight increase of resinous matter, to the extent of a few per cents., namely, of one part of the 7 per cent. increase of the residue remaining after distillation at 290° C. This point is of importance, as interested parties have attempted to explain the presence of 30 to 40 per cent. of resin in the commercial oil as formed by a natural process. Messrs. Schimmel have shown that in good samples of oil, such as the *Cheong Loong* and *Yan Loong* brands, we may expect to find from 6 to 8 per cent. of soft distillation residue, and in adulterated oils from 20 to 30 or even 40 per cent. of a hard residue, indicating adulteration with colophony. E. Hirschsohn (*Pharm. Zeitsch. f. Russ.*, 1890) has proposed the following simple test for the oil:—If to a solution of cassia oil in 70 per cent., alcohol in the proportion of 1 : 3 is added, drop by drop, to half its volume, a solution (saturated at the temperature of the room) of lead acetate in alcohol of the same strength, it should show no precipitate, otherwise colophony or a similar resin is present. For further information on the adulteration of this oil, the reader is referred to the *Berichte von Schimmel & Co.*, Oct. 1890.

Commerce.—The annual imports of Chinese cassia range from about 15 to 20 thousand cwts. in alternate years. The greater part of it is shipped from Hong-Kong to Bombay, some goes to Calcutta, and a very small quantity to Madras. The following tables show the imports and re-exports for 1884-85 :—

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Imports.

Presidency to which imported.	Quantity.	Value.	Country from which imported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay	12,308	2,01,944	Aden	......	3
Bengal	2,226	41,460	China	13,557	2,24,805
Madras	235	4,940	Straits............	1,212	23,536
Total......	14,769	2,48,344	Total......	14,769	2,48,344

Re-exports.

Presidency from which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay.........	4,675	81,114	Persia	2,785	48,826
Bengal	13	225	Arabia...........	980	17,051
Sind	4	55	Turkey in Asia	715	11,956
			Other countries	212	3,561
Total......	4,692	81,394	Total......	4,692	81,394

—(*Dictionary of Econ. Prod. India,* Vol. II., p. 323.)

Chinese cassia fetches in Bombay from 3½ to 4 annas the pound. Malabar cassia about Rs. 5 for the maund of 37½ lbs. Chinese oil sells for about Rs. 2½ per catty.

Taj or **Kalfah,** Indian cassia or cinnamon, is chiefly the product of *C. Tamala,* and *C. iners* and *nitidum,* considered by some botanists to be only coarse forms of *C. zeylanicum,* Breyn. *C. Tamala* is a native of the tropical and subtropical Himalaya from the Indus to Bhotan, and supplies the *Taj* of the N.-W. Provinces, Punjab and Bengal, whilst *C. iners* and *nitidum* supply Southern and Western India. The bark of these trees occurs in flat or slightly quilled pieces, is thicker than the Chinese bark and of a deeper colour; it has a strong cinnamon odour and taste, but is deficient in sweetness. It is now often sent into the market, tied up in bundles, to imitate

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China cassia, the outer layer of the bark having been to a great extent removed; this is probably prepared for exportation as *cassia lignea.* Some trees of *cassia lignea* are cultivated by the Madras Forest Department in the Wynaad. Indian cassia may readily be distinguished from the China bark by its yielding a glairy mucilage when infused in cold water, which gives a ropy precipitate with corrosive sublimate and neutral acetate of lead, but not with alcohol.

No oil is distilled from these barks in India.

Tajpat or **Tamalpatra,** and in Southern India only **Talisha-pattiri,** is the leaf of the species of *Cinnamomum,* already mentioned as yielding *Taj* or Indian cinnamon. The drug is the Tamáli of the Rája Nirghanta, and is considered to be hot and light, and useful for the expulsion of phlegmatic and rheumatic humors; it is prescribed in flatulence and dyspepsia.

Cinnamon leaves are the *Sázaj-i-Hindi* of the Indian Mahometans, and are much used both as a condiment and medicine in India. The author of the *Makhzan* describes them as yellowish, coriaceous, ovate-lanceolate leaves, with five nerves extending from the base to the apex, and says that they are produced by a large tree growing in the mountains of Sylhet, the bark of which is used as cassia. He considers them to be carminative, stimulant, diuretic, diaphoretic, lactagogue and deobstruent.

Description.—The leaves vary a good deal in size, the largest are 6 inches long or more, and 1½ inch broad, oblong, obtuse-pointed, entire, with three principal nerves and two smaller ones which are sometimes quite marginal; the venation between these nerves, which run from base to apex of the leaf, is finely reticulated. The leaves are of an olive-green colour, the upper surface is polished. They have a pleasant odour like a mixture of cloves and cinnamon. Value, Re. 1¼ per 37½ lbs.

According to Professor E. Schmidt (*Chem. Zeit.*, Sept. 26, 1891, p. 1376), the essential oil of cinnamon leaves consists of almost pure eugenol, with a little terpene and cinnamic aldehyde,

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while the oil from the root also contains eugenol and terpene, together with much safrol and benzaldehyde. Both of these oils, therefore, differ from the essential oil from the bark, which consists of cinnamic aldehyde and terpene.

Kálá Nágkesar.—Under this name the immature fruit of the trees yielding cassia is imported into Bombay from China and Southern India.

Kálá Nágkesar (known in Europe as cassia buds) consists of a small brown mucronate berry, the size of a grain of millet, enclosed in a 6-partite calyx half an inch long, which is articulated to a slender pedicel; the calyx and pedicel are of the dark-brown colour of the clove, and have a strong cinnamon odour and taste. The properties of the spice would appear to be the same as those of cinnamon. Two kinds are found in the Bombay market, Chinese and Malabar; they are used as a spice by the Mahometans. Mohideen Sheriff says that the native druggists in Madras substitute cassia buds for *Nagkesar-ke-phul*, the flowers of *Mesua ferrea* and *Ochrocarpus longifolius*; the latter drugs being never met with in the bazars. For an account of the use of the Chinese buds as a spice in Europe from the 14th century up to the present time, see *Pharmacographia*, 2nd Ed., p. 533. Hamburg in 1876 imported 1,324 cwts. (*Op. cit.*)

Pishin-puttai (Gum-bark). Several mucilaginous barks are sold and used under this name in Southern India. Mohideen Sheriff refers the Madras drug to *Tetranthera Roxburghii* (see next article). A specimen supplied by Dr. Mootoosawmy from Tanjore had a very pleasant and lasting aroma, and appeared to belong to an arboreous cinnamon. It is used for its mucilaginous and demulcent properties in medicine, and also by Mahomedan perfumers for making incense or flavouring-sticks ("Samburany-vathe") from the powdered bark. We have also received three other drugs of this name from Travancore. One was a thick red fibrous bark like that of a Litsæa, and was an article of trade among sugar and jagary makers on the Western Coast. The second was a lighter coloured bark and quite free from odour and taste; this was recognised as *Kydia*

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calycina. The third sample was sent by the Conservator of Forests for Travancore, who supposed it to be from a species of Cordia. It was light coloured, very fibrous and free from odour and taste, and is used in native medicine in the State under its Malyalim name *avi-tholi*. Mucilaginous barks are largely employed in India by arrack makers in regulating the fermentation of toddy and precipitating albuminous matters.

The Tanjore *pishin-puttai* gave no reaction indicating the presence of an alkaloid, but the red bark from Travancore gave marked reactions for *laurotetanine*.

LITSÆA SEBIFERA, *Pers.*

Fig.—*Bot. Reg.*, *t.* 893 ; *Roxb. Cor. Pl. ii.*, *t.* 147. *Syn.*: *Tetranthera laurifolia*, Jacq.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Maida-lakri (*Hind.*), Mushaippé-yetti, Maida-lakti (*Tam.*), Naramámidi, Méda (*Tel.*), Kukur-chita (*Beng.*), Méda-lakadi (*Mar.*), Maeda-lakari (*Guz.*).

History, Uses, &c.—We have been unable to trace the history of the use of this bark as a medicine. It is one of the best known and most popular of native drugs, being used internally, on account of its demulcent properties, in diarrhœa and dysentery, and externally as an emollient application to bruises, &c. Maida-lakri, as far as we know, is not mentioned by Sanskrit writers, but from the vernacular names it would appear to be used as a substitute for the *Méda* of the ancient Hindu physicians, one of the *Ashtavarga*, and unknown to the modern Hindus. In Bengal *Asvagandha* is used. In Mahometan works it is briefly noticed under the names of *Maghath-i-Hindi* and *Kilz*. The author of the *Makhzan-el-Adwiya* states that it has the same essential properties as Maghath, being resolvent, astringent, and a nervine tonic useful in paralysis. It would appear then to have been adopted by Mahometan physicians in India as a substitute for an Arabian drug called Maghath, the botanical source of which is uncertain.

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L. sebifera is called *Miri* by the Maratha peasantry, from the resemblance of its globular fruit to a corn of black pepper. The seed is oily and yields a solid white fat. The leaves have a pleasant odour of cinnamon.

Description.—The bark varies in thickness from $\frac{1}{10}$ to $\frac{3}{10}$ of an inch; externally it has several layers of whitish, scabrous, corky tissue, the remaining portion is of a chocolate brown colour. The odour is feebly balsamic; when placed in water it affords a large quantity of bland mucilage, having a faint agreeable aroma. If the bark is old, the aroma disappears, but the mucilaginous qualities remain unimpaired.

The parenchyma, which is chiefly composed of mucilage cells, contains abundance of reddish-brown colouring matter. There is a zone of stony cells, but no distinctive characteristics.

Chemical composition.—This bark, an authentic specimen of which was supplied by Mr. Hollingsworth of the Madras Medical College, gave, on an air-dried sample, 4·6 per cent. of ash, and 14·2 per cent. of alcoholic extract, affording very strong reactions with alkaloidal tests. On separating the alkaloid it was found to agree with the characters of *Laurotetanine*, an alkaloid which has been discovered by M. Greshoff in three species of Litsæa in Java, and in several other plants of the natural order Laurineæ. Laurotetanine is crystalline, and has a strong tetanic action on animals; it is sparingly soluble in ether, more readily in chloroform. It is precipitated by sodium carbonate from solutions of its salts, but readily redissolves in an excess of potash or soda, and is precipitated by the usual alkaloidal reagents. It gives a dark indigo-blue coloration with Erdmann's reagent, a pale rose-red with pure sulphuric acid, and a reddish-brown with nitric acid. A base, which seems to be identical with laurotetanine, is also found in the varieties of *Tetranthera, Notophœbe, Aperula, Actinodaphne* and *Illigera pulchra.* It is also possible that Laurotetanine is the alkaloid discovered in 1886 by Eijkman in *Haasia squarrosa*, Z. et M. (*Meded. uit S'Lands Plantentuin*, vii., p. 77-101.)

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Commerce.—The bark is largely collected in the Central Provinces, and comes to market in large half quills from one to two feet in length and two to three inches in diameter. As met with in the retail shops, it is generally broken into small pieces a few inches in length. Value, Rs. 6 per maund of 41 pounds.

Litsæa Stocksii, *Hook. f.*, in Marathi *Pisi*, is a tree of the hilly districts of the Concan and Canara; when in fruit its scarlet berries make it a conspicuous object. A cold infusion of the leaves is mucilaginous, and is used in irritation of the bladder and urethra. The oil of the seeds, *Pisa-taila*, is used as an application to sprains and itch.

Description.—Leaves 4 to 6 inches, penninerved, coriaceous, oblong-lanceolate or oblanceolate, rarely obovoid acute or acuminate, glaucous beneath, greenish above with impressed nerves, petiole $\frac{1}{8}$ to $\frac{1}{2}$ inch. Berries apiculate, scarlet, about the size and shape of a small acorn, pulp yellow, seed brown, polished, oblong, testa thin, brittle; kernel oily, white, the cut surface turning red on exposure to the air; taste aromatic, pungent like cubebs; the expressed oil solidifies into a white solid fat; as prepared by the natives it has a reddish colour, due to admixture of resinous matter. The bark and leaves are mucilaginous and not aromatic.

Chemical composition.—The dried and powdered red fruits of this tree yielded to ether 31·6 per cent. of extract consisting mainly of crystalline fats. Petroleum ether separated this extract into a soluble fatty portion, and an insoluble neutral reddish resin. The petroleum ether solution left on evaporation some fatty acids melting at 39° and solidifying at 35°, but which, on crystillization from boiling alcohol and pressure between filtering paper, afforded some purely white crystals melting at 42·5. The fatty acids would appear to consist of lauric acid with a small admixture of oleic acid.

The resin in the fruits was associated with a volatile oil to which the fragrance is due. The alkaloid detected in the

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spirituous and the watery extracts of the drug had the reactions of *laurotetanine*. The dried fruits left after ignition 4·77 per cent. of mineral matter.

LAURUS NOBILIS, *Linn.*

Fig.—*Bentl. and Trim., t.* 221. Laurel Bay (*Eng.*), Laurier (*Fr.*).

Hab.—Southern Europe. The berries.

Vernacular.—Hab-el-ghár (*Ind. Bazars*).

History, Uses, &c.—Bay berries were introduced into India by the Mahometans, and are still kept by their druggists in all the larger towns. The Bay or Noble laurel is the Daphne (δαφνη) of Dioscorides, which he describes as hot, demulcent, astringent and stomachic, and recommends the berries in φθίσις and chest affections, and as a stimulant adjunct to wine and ointments. This shrub was held in great esteem by the ancients, who relate that the nymph Daphne, when pursued by Apollo, and on the point of being overtaken by the god, prayed for aid, and was changed into a Bay tree. Prof. Max Müller compares this Greek myth to the Vedic myth of Urvási and Pururavas. The Bay was also used in conjuration; the young girl, who had been forsaken in the second idyl of Theocritus, says:—

> Δέλφις ἔμ' ἀνίασεν. ἐγὼ δ' ἐπὶ Δέλφιδι δάφναν
> Αἴθω. χ' ὡς αὐτὰ λακεῖ μέγα, καππυρίσασα,
> Κὴξαπίνας ἄφθη, κοὐδὲ σποδὸν εἴδομες αὐτᾶς,
> Οὕτω τοι καὶ Δέλφις ἐνὶ φλογὶ σάρκ' ἀμαθύνοι.

The priestesses of Apollo consulted the tree and ate of its leaves before delivering the oracles at Delphi. Hesiod tells us that the muses held branches of it in their hands, and poets are still nominally crowned with a laurel wreath. It was also an emblem of victory, and was used by the Romans in many of their ceremonies.

Oil of Bay berries, the δαφνέλαιον of Dioscorides, is still used in Southern Europe as a nervine stimulant. A medicinal oil is also prepared with the leaves and olive oil, which is much used

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in the south of France. The leaves are also considered to be febrifuge, and are used in all European countries for flavouring pastry. In America the dry leaves are largely distilled for the essential oil, which is used for the preparation of Bay Rum, a favorite hair-wash, the disinfectant action of which is due to the eugenol contained in Bay oil. Bayberry oil or expressed laurel oil is obtained from both the fresh and dried berries. The fresh berries are bruised, boiled in water, and pressed in a sack. The expressed oil is then mixed with the decoction, and when cold the oil is found floating on the surface. Dried berries are first exposed to steam, and then subjected to pressure between heated metallic plates. The oil has a butyraceous consistence, and granular appearance. Its colour is greenish, taste bitter and aromatic, with an odour like that of the berries. It melts at 86°—95° F. It is wholly soluble in ether, but alcohol only dissolves green colouring matter and the volatile oil. The solubility in ether affords a test of its purity; if admixed with lard, the ethereal solution is turbid and milky. (*Brannt.*)

Description.—Bay berries are oval or subglobular drupes about $\frac{1}{3}$ to $\frac{1}{2}$ an inch long. When dry, they are greenish-black or blackish-brown, slightly wrinkled, and fragile, the integuments, including the reddish-brown endocarp, being thin and brittle. The loose oval seed is easily separated into the two plano-convex brownish cotyledons, which have an aromatic, oily, and bitter taste.

Chemical composition.—The leaves and fruit contain a volatile oil. The volatile oil of Bay berries is pale yellow, sp. gr. 0·91, it congeals at a low temperature, contains oxygen, and is easily soluble in alcohol; it contains hydrocarbons, $C^{10}H^{16}$, boiling at 171° C. and 250° C., and four oxygenated constituents (Staub). Gladstone (1863) had found eugenol, while Blas (1865) could not detect this, but proved the presence of a little lauric acid. Bley (1834) obtained from old berries ·22 per cent. of volatile oil. The seeds contain, according to Bonastre (1824), about 20 per cent.

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of fat, 2 per cent. of volatile oil, and 1·5 per cent. of resin. The expressed fat was analysed by A. Staub (1879), who determined, besides volatile oil and chlorophyll, the presence of a little acetic acid and the glycerides of oleic, linoleic, lauric, myristic, palmitic, and stearic acids. *Lauric acid*, $C^{12}H^{24}O^{2}$, discovered by Marsson (1842), has been found in many vegetable and a few animal fats; it melts at 43·5° C., and volatilizes with the vapours of boiling water (Goergey, 1848). Schmidt and Roemer found little free acid in the freshly-expressed oil, but the fruit contained 2 to 3 per cent. of fatty acids. (*National Disp.*)

Cassytha filiformis, *Linn.*, *Rheede, Hort. Mal. vii., t.* 44; A'kásvel (*Mar.*), Amarbeli (*Hind.*), A'kásavalli (*Sans.*), is a common parasite on bushes; it consists of a tangled mass of tough dark-green stems, branched, marked longitudinally with delicate pale green lines, the largest are the size of a crow-quill; the branches are provided with small round suckers, like those of the common dodder. Sections of the stem show a strong fibro-vascular layer and loose central pith. The fruit is globular, of the size of a pea, and surmounted by the remains of the sepals; on removing the outer envelope, which is tough, an inner envelope is exposed, which consists of two layers, the outer cartilaginous, the inner fleshy and lined with white hairs, each containing a delicate spiral filament; within this central cavity is a third delicate membranous envelope covered with hairs, of a similar description, and containing the ovule. The whole plant is used in native practice as an alterative in bilious affections and for piles. In Southern Africa it is said to be used for washing the head, destroying vermin, and making the hair grow. In Senegambia it is employed in urethritis, and in Cochin-China as an anti-syphilitic.

Chemical composition.—M. Greshoff has detected an alkaloid in this plant, having the following colour reactions: sulphuric acid faint red, Erdmann's reagent (sulphuric acid mixed with a little nitric acid) blue, nitric acid red-brown,

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Fröhde's reagent dirty blue. Dr. Greshoff believes that on a closer investigation of this alkaloid, it will be found to be identical with laurotetanine described under *Litsæa sebifera.*

THYMELÆACEÆ.

AQUILARIA AGALLOCHA, *Roxb.*

Fig.—*Roxb. & Coleb. in Trans. Linn. Soc. xxi., t.* 21; *Royle Ill., t.* 36, *f.* 1.

Hab.—Eastern Himalaya, Bhotan, Assam, Khasia Mts., Silhet and Tippera Hills, Martaban Hills.

AQUILARIA MALACCENSIS, *Lamk.*

Fig.—*Lamk. Ill., t.* 356; *Cav. Diss. vii., t.* 224; *Rumph. Amb. ii., t.* 10.

Hab.—Malacca, Malay Islands. Eagle or Aloe wood (*Eng.*), Bois de Calambac (*Fr.*).

Vernacular.—Agar, Agaru (*Indian Bazars*).

History, Uses, &c.—The use of this precious wood as a perfume and medicine is of great antiquity. Together with myrrh, cassia, and other products of the East, it is mentioned in the sacred writings of the Jews (*Num.* 24, 6; *Psalm.* 45, 8; *Prov.* 7, 17; *Cantic.* 4, 14) under the name of Ahalot or Ahalim. It is the ἀγάλλοχον of the ancient Greeks, which is described by Dioscorides as a wood brought from India and Arabia. Later writers, from Aëtius' time, call it ξυλάλοη or "aloe wood," the name by which it is still known in Europe. The same substance is the Agaru of the Hindus, the Garu of the Malays, and the Chin-heang of the Chinese. In Sanskrit medical works it bears the synonyms of Rájárha "worthy of a prince," Visva-rupa "taking all forms," Krimi-ja "produced by worms," Krimi-jagdha, Anarya-ja "produced in a non-Aryan country," Kanaka "golden," Káliya "black," &c., and is described as hot,

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light, and cholagogue; removing diseases of the ear, nose and eyes. In native practice Agar is used as a deobstruent, stimulant, carminative, and tonic; it is said to relieve the pain in gout, and to check vomiting. Susruta directs Aguru, Guggula,* Sarjarasa,† Vacha,‡ white mustard, Nim leaves and salt to be made into a paste with ghí to form an anodyne fumigation for surgical wounds, called in Sanskrit *Vedanárakshoghnair-dhupaih.* As aloe wood bears the Sanskrit name of Anarya-ja, it is probable that it was used by the aborigines of Eastern Asia before it became known to the Hindus, but that at a very early date it was carried overland to Central Asia and Persia, and from thence reached Arabia and Europe.

The early Arab travellers appear to have collected a good deal of information concerning the commerce and sources of supply of the wood.

Yohanna-bin-Serapion mentions four kinds, *Hindi, Mandali, Sinfi* and *Kamári,* and Ibn Sina in the 10th century has the following account of it:—"The best is called *Mandali* from the more central parts of India; next is the Indian or Hill aloe wood, which has the advantage over Mandali of preserving clothes from lice. Some say that Mandali and Indian aloe wood are the same. One of the best kinds is *Samandúri* from Sofala in India; again there is the *Kamári* and the *Samfi* from the same parts, and there is *Kákuli,* and *Kismúri* which is moist and sweet; and the worst kinds are *Halái, Kamtái, Mabatái, Lawathi,* or *Rabatáthi.* Mandali is the best; then Samandúri, of a grey colour, fat and oily, heavy, without any white streaks, and which burns slowly. Some consider black aloe wood better than grey, and the best black is the Kamári, without white streaks, fat and oily, which burns slowly. In short, the best aloe wood is black, hard, and heavy, sinks in water, is not fibrous when powdered; that which does not sink is bad. The tree is said to be buried to promote the formation of aloe wood." The Arabian travellers give much the

* Resin of Boswellia serrata.

† Resin of Shorea robusta.

‡ Acorus Calamus.

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same names to different kinds of the wood. Ibn Batuta speaks of Kamári as soft, like wax. Abu Zaid calls it Kamarúni, and says it is the best kind. Abulfeda states that it comes from the Kamarún Mountains. Kákuli is said to derive its name from Kókaleh in Java. The epithets Máwardi, Saimuri and Jáwi are also applied by some writers to aloe wood. As regards the identification of these localities, we would remark that *Samfi* is probably derived from Champa, a province in Cambodia; *Mandali*, from Mount Mandar or Mandal, south of the modern town of Bhagalpur in Bengal; Kámari or Kamaruni, from Kamarun, the Arab name for Cape Comorin; Saimúri, from Saimur or Samar, an island in the Eastern Archipelago; Halái may possibly be derived from the Hala Mountains between Sind and Beluchistan, as Abu Zaid says that the best aloe wood is brought for sale by Multanis.

Haji Zein-el-Attár (1368) calls aloe wood Ood-el-júj, and in Persian, Ood and Balanjúj. After translating Ibn Sina's article on Ood, he gives his own opinion in the following terms: "The author of this work (*Ikhtiarat-i-badiaa*) says the best is called *Kalambak* (کلنبک), and comes from the port of Jena, which is ten days' sail from Java; it is sold for its weight in gold; you would think it odourless, but when warmed in the hand it has a very sweet persistent odour; when burnt, the odour is uniformly sweet until the wood is consumed. Next is *Mandali* and *Samandúri*, both from Sofala in India, the best of these is of a golden colour and heavy. *Kákuli* is like the Indian, and is generally in large pieces, marked with black and yellow lines; then there is *Kamári*, golden-brown, without white streaks, it comes from Kamarún and Sofala; then *Samfi*, from Samp, it is very hard and sweet; then *Sakáli* and *Afasi*, a moist kind from China; then *Mantai*, *Randi*, *Halai*, and *Lanfi*, all of about equal value. And in Manta there is a tribe who call the wood *Ashbáh*, and it is of two kinds: one of these is in large pieces weighing from 5 to 50 maunds, without much odour, and used for making combs, knife handles, &c.

Mir Muhammad Husain (1770) writes:—"Ood, in Hindi Agar, is the wood of a tree which grows in the Jaintiya hills

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near Sylhet, a dependency of the Súbah of Bengal, situated towards the north-east of Bengal Proper. The tree is also found in the islands to the south of Bengal, situated north of the Equator, and in the Chatian islands belonging to the town of Nawaka, near the boundaries of China. The tree is very large, the stem and branches generally crooked, the wood soft. From the wood are manufactured walking sticks, cups, and other vessels; it is liable to decay, and the diseased part then becomes infiltrated with an odoriferous secretion. In order to expedite this change it is often buried in wet ground. Parts which have undergone the change above mentioned become oily, heavy, and black. They are cut out and tested by being thrown into water; those which sink are called *Gharki*, those which partly sink *Nim Gharki*, or *Samáleh-i-aala*, and those which float *Samáleh;* the last kind is much the most common. Gharki is of a black colour, and the other qualities dark and light-brown."

The best kind for medicinal use is Gharki Ood from Sylhet; it should be bitter, odoriferous, oily and a little astringent; other kinds are considered inferior. In most receipts raw Ood (Ood-i-khám) is enjoined to be used to prevent the use of wood from which the oil has been abstracted by crushing and maceration in water, or by crushing and admixture with almonds, which are afterwards expressed.* This precaution is the more necessary as Ood shavings are an article of commerce in India under the name of *Chúra agar;* they are often adulterated with chips of Sandalwood, or Taggar, an odoriferous wood, common in India.

Rumphius describes two kinds of true, and two of false, aloe wood; the first kind of true aloe wood, he says, is called Kilam or Ho-Kilam by the Chinese, and Calambac by the Malays, and is produced by a tree growing in the provinces of Champa and Coinam, and in Cochin-China. This tree has been described by Loureiro under the name of *Aloexylon Agallochum.* The second kind, called *Garo*, is the product of *Aquilaria malaccensis*, Lamk.,

* Nicolaus Myrepsicus prescribes *Agallochum crudum.*

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which he figures. This is the Chin-heang of the *Pun-tsaou-kang-muh* or great Chinese Herbal. (See *Hanbury Science Papers*, p. 263.) His two kinds of false aloe wood he attributes to *Michelia Champaca* and *Excœcaria Agallocha.*

Roxburgh and other botanists have examined the Aquilaria in Sylhet, and recently an *Aquilaria* has been ascertained to be the tree which produces aloe wood in the islands of the Mergui Archipelago. Gamble says that "*Akyau* (the Burmese name for aloe wood) is the most important produce of the forests of South Tenasserim and the Mergui Archipelago. It is found in fragments of various shapes and sizes in the centre of the tree, and usually, if not always, where some former injury has been received."

Aloe wood is used throughout the East as an incense and as a perfume, and was formerly used as a medicine in Europe for the same diseases for which it is still prescribed in India.

Collection.—In Sylhet, the collection of aloe wood is a precarious and tedious business; those engaged in it proceed some days' journey into the hilly districts, where they fell any trees they may find, young or old, and then, on the spot, search them for the *Agar*, as the valued wood is called. This is done by chopping off the bark, and into the wood, until they observe dark coloured veins, indicating the proximity of wood of valuable quality, which generally extends but a short distance from the centre of a trunk or branch. In this manner a whole tree is searched through, the collectors carrying away only such pieces as are rich in odoriferous resinous matter. In some districts it is customary to facilitate the extraction of the resinous wood by burying portions of the tree in moist ground, or by allowing the entire tree to remain a length of time after it is cut down, the effect of which is to cause decay in the non-resinous wood, and thus render it easily removable by an iron instrument. Aloe wood is sorted by the collectors into various qualities, the finest of which, called *Gharki*, is worth in Sylhet from 6 to 8 rupees per pound. (*Hanbury Science Papers.*)

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Description.—The wood occurs in irregular pieces, which vary in colour from grey to dark-brown, according to the amount of resin which they contain; both light-coloured and dark pieces are marked with longitudinal veins of a darker colour. The best pieces show numerous cavities and sinuses produced by the cutting away of wood less impregnated with resin; they sink in water. When a portion is chewed, it softens between the teeth; the taste is bitter and aromatic; when burnt, it diffuses an agreeable odour.

Mr. J. G. Prebble has kindly furnished us with the following interesting remarks upon the aloe woods of the Bombay market:—"The true Agar woods are imported into Bombay, in boxes holding about 1½ cwt., from Bankok, and usually *viâ* Singapore or Batavia. Some of the Parsee dealers in Chinese silks also import Agar from Hongkong, in small rectangular parcels holding about 1 lb. each, and bearing a yellow label with the name of the packer in the Chinese character. This Agar which I have examined is the Gaguli variety (*A. Agallocha*), and has been carefully dressed, and polished or painted black. One or more false Agars composed of heavy resinous woods are also imported from Singapore. The true Agars vary considerably in the amount of resin they contain; old and decayed samples consist largely of resin. A good specimen yielded to Hanbury* 48 per cent. of matter soluble in rectified spirit. Compact and not apparently very resinous samples of Gaguli and Mawardi Agar, treated successively with petroleum ether, ether, and alcohol, gave:—

	Volatile oil.	Resin soluble in ether.	Resin soluble in alcohol, insoluble in ether.
Gaguli	½ per cent.	13·8 per cent.	9·4 per cent.
Mawardi	1·5 per cent.	11·6 per cent.	9·0 per cent.

The volatile oil is of a yellow colour, and possesses the characteristic odour of the woods. It gives a reddish-brown

* *Science Papers*, page 265.

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coloration with sulphuric acid. The ether resin is soluble in aqueous solution of potash, with a reddish-brown colour, from which the resin is precipitated by acids. The two true Agars Gaguli and Mawardi are composed of rather thin-walled wood-cells, traversed with numerous one-celled rows of medullary rays which are frequently interrupted by large cellular passages or medullary spots. These structures appear as elongated spots of cellular tissue with their greatest diameter following the periphery of the stem.* In Mawardi Agar the vessels are much larger and more numerous than in Gaguli Agar. The vessels, rays and cellular passages are filled with resin. On comparing sections of the stems, ⅛ inch thick, of herbarium specimens, kindly sent by Dr. King from the Calcutta Herbarium, of *Aquilaria Agallocha* and *A. malaccensis* with the Agars, it was observed that the structure of Gaguli Agar was apparently identical with that of *A. Agallocha*, and I think there is little doubt that this tree is the source of this variety of Agar. Mawardi Agar is also probably derived from *A. malaccensis*. The false Agars have thick-walled wood-cells, less numerous vessels than in the true Agars, and no well-defined medullary spots.

"**Taggar wood** is a heavy, dark-coloured, oily and resinous wood, the botanical origin of which is unknown, imported into Bombay from Zanzibar. It sinks in water, and its aqueous infusion has a yellow colour with a greenish fluorescence From Bombay it is sent to the large cities of Northern India, Delhi, Lucknow, &c., where it is distilled with other ingredients to form some of the compound attars, so much esteemed by the natives.

According to Dr. Royle's Catalogue, Taggar wood was sent from Delhi to the great Exhibition of 1851. Twenty pounds of the ground wood submitted to distillation with water during three consecutive days, with frequent cohobation, yielded six fluid ounces, equivalent to two per cent. of a yellowish oil

* De Bary, *Comparative Anatomy of the Phanerogams and Ferns*, page 492.

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which quickly changed to a reddish-brown colour. The oil is neutral, of sp. gr. ·9546, bitter, and with an odour resembling, but distinct from sandal wood oil. It dissolves in all proportions of alcohol, ether, chloroform, benzol and petroleum ether. It dissolves iodine without violent reaction, and yields no characteristic reaction with sulphuric acid, being only darkened in colour. Exposed to the air in a thin layer, it acquires a crimson colour. At a low temperature, by keeping in ice, the oil remains clear and free from any deposit, but becomes very thick and viscid, and develops a strong greenish fluorescence which vanishes or nearly so at a higher temperature, 85° F. The finely powdered wood, treated successively with petroleum ether, ether, and alcohol, yielded to the petroleum ether 8·75 per cent. of a mixture of volatile oil and resin, which deposited on the sides of the evaporating dish a few small tabular crystals. On drying at 110 C., this mixture of oil and resin lost volatile oil equivalent to 5·75 per cent. The ether extracted a resin, 6·4 per cent., soluble in aqueous solution of potash, with a deep reddish-brown colour and greenish fluorescence, in solutions of ammonia and of carbonate of soda. The resin is precipitated from these solutions by acids. Strong sulphuric acid dissolves the resin with a red colour, from which it is precipitated by water in yellowish-brown flocks. It is readily soluble in glacial acetic acid, but no crystals were obtained on the spontaneous evaporation. It is insoluble in benzol and petroleum ether and in boiling alum solution. The resin probably contains an anthraquinone derivative allied to Emodin and Chrysophanic Acid, but I have not yet succeeded in isolating it. Alcohol extracts a resin, 4·12 per cent., insoluble in ether. Taggar wood is valued in Bombay at about Rs. 3 per maund of 28 lbs."

Mazariyun.—The Mezereon of Mahometan physicians is described in their works upon Materia Medica as a leaf.

It is considered by C. Bauhin to be the *Oneorum tricoccon*, and is probably the same as the *Chamælea* of Scribonius, of which he says: "Purgat belle chamælea, quæ herba olivæ folia similia habet: quorum quinque vel sex dare oportet." (*Comp.* 136.)

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Apuleius Platonicus has the following notice of it:—"Alii pyros agnen, alii heracleon, alii bdelyram, alii coccon gnidion, Romani citocacium, nonnulli oleaginem, quidam oleastellum vocant." (*De Vir. Herb.*, 26.)

Mír Muhammad Husain says there are three kinds, *viz.*, white with large thin leaves, called *Ashkhís*, yellow with yellowish thick leaves, smaller than those of the olive, called in Persian *Haft-barg* and *Musht-rú*, and black with black leaves! The white is to be preferred as the least acrid; but even the leaves of this kind require to be soaked for forty-eight hours in vinegar, which should be several times changed, to make them fit for medicinal use. Having been thus prepared, they are to be washed and dried, and pounded with almond oil. This preparation may then be given in combination with purgatives, bitters and aromatics, in dropsy or in such cases as are benefited by hydrogogue and drastic cathartics, to the extent of 24 grains. Mulla Ahmad Nabtí, in his *Tarikh-el-hukama*, tells a story of a dropsical patient, who was cured by eating locusts which had been feeding upon Mezereon leaves; they acted as a hydrogogue cathartic.

Lasiosiphon eriocephalus, *Dcne., Wight Ic., tt.* 1859-60; *Jacq. Voy. Bot., t.* 150, a native of the Deccan Peninsula and Ceylon, is a shrub with leaves like the willow, and terminal heads of flowers, surrounded by an involucre of oblong, rather hoary leaflets. It is common on the hills of Western India, and the bark is a powerful vesicant, which has not, as far as we are aware, been mentioned in native medical works. The peasantry are, however, acquainted with its properties, and when they have a lean ox or cow to take to market, rub the skin with a decoction of the bark, which causes swelling and an appearance of plumpness, which disappears in a few days much to the discomfiture of the purchaser.

Dr. J. Y. Smith, in his *Matheran Hill, its People, Plants and Animals* (p. 35), says "the *Rametha* bushes are often seen stripped of their bark, which is used for poisoning fish."

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The bark consists of an outer suberous portion which is of a light-brown colour and divided by numerous transverse and longitudinal fissures, so that it can be easily separated, and of an inner layer which is white, tough, and silky like Mezereon. The wood-cells are easily separated and form pretty microscopic objects, as they are beautifully transparent. The taste is acrid.

Chemical composition.—The fresh bark was beaten into a paste in a mortar, and the mass divided and placed in two bottles, one containing ether and the other spirit of wine; they were both shaken occasionally and the mixture allowed to macerate for 24 hours. The ether extract was filtered off and evaporated at a very low temperature until a thick, green, greasy substance was left. This was washed with warm water and a small piece placed upon the skin of the arm and spread so as to cover a space the size of a rupee. In about two hours irritation of the skin was produced, and, on removing the covering of the arm, it was found that several small blisters had formed under the extract and extending beyond it. The alcoholic tincture was then removed by filteration and carefully evaporated at a gentle heat. The residue contained very little of the green-coloured resinous matter, but a large quantity of saccharine substance, which was non-crystalline. This extract was applied to the skin as in the previous experiment, but the application was followed by only a slight reddening due to the small amount of resin in the dried extract. The resin appears to be the source of the vesicating principle of the bark. It has an acid reaction in neutral solvents, is soluble in ammonia with a yellowish-brown colour, and is associated in the ethereal extract with a fatty base which facilitates its use as a blistering agent.

The roots of **Daphne oleoides,** *Schreb., Royle Ill., t.* 81, are used in Afghanistan as a purgative. Aitchison (*Flora of Kuram Valley*) says: "Camels will not eat this shrub except when very hungry. It is poisonous, producing violent diarrhœa. I feel certain that much of the mortality of camels in the Kuram Division was due to the prevalence of this shrub."

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LORANTHACEÆ.

VISCUM ALBUM, *Linn.*

Fig.—*Eng. Bot. xxi., t.* 1470; *Woodv. Med. Bot.*, suppl., *t.* 270. White Mistletoe (*Eng.*), Gui (*Fr.*).

Hab.—Temperate Himalaya. Westward to the Atlantic. The berries.

Vernacular.—Kismish-kawali (*Ind. Bazars*).

History, Uses, &c.—Mistletoe is the ἰξὸς of Theophrastus and Dioscorides, and was considered by the ancients to have discutient properties. It was applied to disperse tumors and to mature abscesses, and was given internally in enlargement of the spleen. Matthiolus and Paracelsus recommend it in epilepsy, and Kölderer, Cartheusar, Colbatch, Löseke, Van Swieten and others have stated that they found it beneficial not only in this disease, but in other convulsive affections. This plant was formerly held to be sacred in Europe, and in ancient Britain it was cut with a golden sickle by a Druid in white robes, amid the sacrifice of victims and the fasting of devotees. Thus obtained, the *Gwid* was considered a heal-all, a charm against disasters, and the emblem of fertility. As such it was a special object of worship with the ancient Britons, who called it *uchelfa*, a high place, *uchellawr*, the most exalted, *uchelwydd*, the lofty shrub, *awyrbren*, the ethereal tree, *prenpuraur*, the tree of pure gold, &c.—names still surviving in the Welsh language.

Pliny (xvi., 93, 94, 95) describes the Viscum, and the method of making birdlime from it; he also notices the superstitions held concerning it by the Gauls, and its worship on the fifth day of the moon, the day which is the beginning of their months and years. A festival in honour of the mistletoe called *Guilanleu* or *Guilanneuf* (gui de l'an neuf) was held in France as late as the 16th century, and in England the plant still hangs in the hall at Christmas.

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The dried berries sold in the bazars as *Kismish-kawali*, or more correctly *Kismish-i-káwaliyán*, are also called Muizak-i-asli, and in Arabic, Dibk.

Káwali or Kauli is the name of a gipsy tribe in Persia. Baron C. A. de Bode, in his *Travels in Luristan and Arabistan* (Vol. II., p. 100), mentions his being shown in the forests of the Zagros mountains, on the road from Kirmanshah to Baghdad, a fruit called by the natives Angur-i-Kauli, or grapes of the Kauli, which grow on the Mázu or gall-tree (oak), of a yellowish transparent colour, sometimes used as glue.

The hakím Dáwúd says of Dibk (in a passage which is imperfect in the *Táj el Arús*) "it is found upon the tree in like manner as lichen (الشيبة), but is a berry, like the chickpea (حمص) in roundness; . . . . the best thereof is the smooth, soft, with much moisture, inclining, in its exterior, to greenness, and it is mostly found upon the oak; when it is cooked with honey and دبس (juice of fresh dates, &c.) . . . . and drawn out into longish strings, and put upon trees, the birds become caught by it." (*Madd el Kámús.*) The author of the *Makhzan-el-Adwiya* has the following account of it:—"A berry smaller than the seed of *Cicer arietinum*, green when fresh, but when dry shrivelled and of a brown colour, the contents are moist and viscid, the seeds about the size of poppy-seeds. The plant is parasitic upon the pear and other trees, and consists of several branches, the leaves are like those of the pomegranate, and of a pale green. Properties resolvent and laxative, a solvent of corrupt humors which it withdraws from the system. When steeped in hot water, strained, and beaten up with the kernels of the walnut or castor oil (which is the usual form of administration), it clears the system of adust bile and phlegm, removes obstructions, and is a remedy for lumbago, piles, &c. Applied externally it promotes the suppuration, or causes the dispersion of tumors or enlargements. Sportsmen use it as birdlime, and dyers as a mordant for crimson."

Of recent years, mistleloe has again attracted attention as a medicine. Dr. W. H. Long (*New Remedies*, 1878, p. 112) after,

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ten years' experience of it as an oxytocic, arrived at the conclusion that it is superior to ergot. He used it also in the forms of infusion, tincture, decoction and fluid extract in many cases of menorrhagia and post-partum hæmorrhage with gratifying results. He conceived that it incited the natural, rather than the tonic, contraction of the uterus. A physician in South Carolina refers to three cases of abortion in negroes produced by this plant. (*Med. Rec.*, xvii., 276; *Stillé and Maisch.*, *Nat. Disp.*, 1884, p. 1617.) Dr. R. Park speaks of a tincture of *Viscum album* as a valuable substitute for Digitalis; the ecbolic action of the plant, he says, is more energetic than that of ergot. Dose, 10—60 grains.

Description.—The dried berries are about $\frac{1}{3}$ of an inch in diameter, soft, brown, and shrivelled; they contain a small seed about the size of a poppy-seed. When crushed they are very sticky.

Chemical composition.—M. Pavlevsky (*Bull. Soc. Chim.* (2), xxxiv., 348) has obtained from the leaves of *V. album* a crystallizable acid corresponding to the formula CH^4O^4 or $(CH^3O^3)\ HO$. It forms large prisms insoluble in alcohol and ether, slightly soluble in water, and fusing at 101—103°C. It is obtained by boiling the leaves with water acidulated with nitric acid, and allowing the decoction to cool. The silver salt of this acid is explosive. (*Year-Book of Pharm.*, 1881, p. 63.)

The berries contain a substance which has been named *Viscin* by Reinsch, who obtained it from birdlime by digesting it with 90 per cent. alcohol as long as it coloured that liquid yellow, after which it was boiled repeatedly with alcohol to remove wax. The remaining yellowish-brown mass, when treated five or six times with ether, gave up viscin, whilst *viscaoutchin* and woody fibre remained undissolved. The ethereal solution was then evaporated, and the viscid yellow mass thus obtained kneaded with alcohol so long as it gave off colouring matter. It was then kneaded under water, and heated to 120°, without access of air, until the whole of the water was expelled. Viscin is a clear transparent mass, of the consistence of honey

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at ordinary temperatures, and capable of being drawn out into long threads; fluid at 100°, like oil of almonds; sp. gr. 1. It produces a greasy stain on paper, is nearly inodorous and tasteless, and has an acid reaction. Formula $C^{40}H^{48}O^{16}$. Viscaoutchin remains behind, together with woody fibre, after the extraction of viscin by ether as above, and is taken up by oil of turpentine. After distilling off the turpentine, the yellowish mass is dissolved in ether, in which it has now become soluble; the ethereal solution is evaporated, and the residue is washed with alcohol and water, and dried at 120°. At ordinary temperatures it is viscid, and resembles vegetable wax; at 120° it is of the consistence of olive oil. It is very elastic, and may be drawn out into long threads; sp. gr. 0·978. It is tasteless, of faint odour and neutral reaction. Formula $C^{40}H^{37}O^{5}$. (*Gmelin*, xvii., p. 352.)

Viscum et **Loranthus,** sp. var. In the *Pharmacopœia of India*, the leaves of a Viscum, doubtfully referred to *V. monoicum* (Kuchila ke molung), growing on Nux Vomica trees in the neighbourhood of Cuttack, are stated to possess poisonous properties similar to those of the tree on which the plant grows. The subject was investigated in 1837 by Sir W. O'Shaughnessy, who is said to have detected in the powdered leaves the presence of strychnine and brucine: and the leaves were for a time used by Dr. Duncan Stewart and others as a substitute for Nux Vomica. A case of what is stated to have been fatal poisoning by the leaves is mentioned by Norman Chevers in his work on *Indian Medical Jurisprudence*. The symptoms were those of strychnia poisoning. In 1861 Mr. Leon Souberain (*Pharm. Journ.*, p. 568) published an account of a poisonous species of Loranthus found on the Nilgiris, growing on Nux Vomica trees, and known to the natives as *Poulourivi*.

In Pudukota, a decoction of a species of Loranthus called *Pillooroovi* or *Kooroonthoo*, probably the same plant, is applied to skin diseases to relieve itching.

Under the name of *Bandákpushp*, the flowers of *Loranthus longiflorus*, Desrouss., *Rheede, Hort. Mal., x., t.* 4, have been sent

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to us from Poona as having a reputation among the Hindus as a remedy in consumption, asthma, and mania; they are astringent.

Dr. Buchanan-Hamilton, when in Mysore, was shown the *Loranthus falcatus*, Linn. ('Wotu,' *Canarese*), the bark of which was used by the poorer natives in place of betel-nut; with quicklime it tinges the saliva and mouth of a fine red, brighter even than that communicated by the Areca.

In Travancore, the Loranthaceous parasites on the Nux Vomica are called *Kanjiram-eitthal* in Malayalim, and are used in medicine by the natives, but when the parasites are scarce, the young leaves of the Nux Vomica tree are used as a substitute.

A contribution by M. A. Chatin to the Paris Academy of Sciences entirely contradicts the statement we have extracted from the *Pharmacopœia of India*, and the belief of the natives that these parasites partake of the nature of the plants upon which they grow; so that the old ideas concerning the non-elaboration of sap by parasitic plants will have to be abandoned.

M. Chatin finds that the tannin of the mistletoe is not identical with that of the oak on which it grows, but gives a green colour and not a blue-black with iron salts; that the *Loranthus*, which grows on *Strychnos Nux Vomica*, does not, as has been asserted, contain a trace of either strychnine or brucine, and that the *Balanophora* parasitic on *Cinchona Calisaya* does not contain any of the alkaloids of cinchona barks. The *Loranthus* growing on orange trees never partakes of the yellow colour of the wood of its host plant, nor does the *Orobanche* of the hemp possess the odour of the latter; while *Hydnora africana*, used as food in South Africa by the Hottentots, grows on an acrid and even vesicating *Euphorbia*. It is evident, therefore, that the sap absorbed from the host plant must be modified by the parasite to form its own peculiar products. (*Pharm. Journ.*, May 2nd, 1891.)

The Forest Officer of Ganjam, a district where the Strychnos grows so plentifully, sent to one of us a specimen of a species of Viscum taken from these trees, which was identified as

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V. articulatum. The sample was a small one, but it was sufficient to determine by analysis that the trace of alkaloid present was neither strychnine nor brucine. The leaves contained a peculiar tannic acid, giving a green precipitate with ferric salts, and a resin soluble in ether and alcohol, striking a blood-red colour with strong sulphuric acid. The chemical constituents of the leaves of the parasite were altogether different to those of the leaves of the Nux Vomica tree.

SANTALACEÆ.

SANTALUM ALBUM, *Linn.*

Fig.—*Bedd. Fl. Sylv., t.* 256; *Hayne, Arnz. Gewachs. x., t.* 1; *Bentl. and Trim., t.* 292; *Rumph. Amb. ii., t.* 11. Sandalwood (*Eng.*), Santal blanc (*Fr.*).

Hab.—Deccan Peninsula. The wood and essential oil.

Vernacular.—Chandan, Sufed-chandan (*Hind.*), Sandanak-kattai (*Tam.*), Gandhapu-chekka (*Tel.*), Chandana-mutti (*Mal.*), Gandhada-chekke (*Can.*), Chandon, Sada-chandon (*Beng.*), Chandana, Sukhada (*Guz.*), Chandana, Gandha-che-khor (*Mar.*).

History, Uses, &c.—Sanskrit writers make two kinds of Chandana: the darker, heartwood, they call *Pitachandana,* or yellow Sandal; and the lighter wood, *Srikhanda,* or white Sandal. Chandana is mentioned in the *Nirukta,* or writings of Yaska, the oldest Vedic commentary extant, said to be written not later than the 5th century B.C. It is also referred to in the ancient epic poems of the Hindus, the *Ramayana* and *Mahabharata.*

According to the *Kathásaritságara,* it is one of the trees of the Buddhic paradise, and the chariot of the sun is made of its wood bound with gold.

Sanskrit medical writers describe sandalwood as bitter, cooling, astringent, and useful in bilious fever and heat of body;

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a paste of the wood is directed to be applied externally to inflammatory affections of the skin, and is a domestic remedy for all kinds of pains and aches. Under the name of *gandh* (perfume), it is largely used in Hindu ceremonial, being smeared upon idols and upon the foreheads of their worshippers. The wood is chiefly consumed at the *chita* or funeral pile, even comparatively poor people spending as much as fifty rupees upon it. The Parsees also use it at their funeral ceremonies. Mahometan medical writers, commencing with Masih and Ibn Sina, call the wood Sandal, and follow the Hindus in distinguishing the dark-coloured portion from the light. The author of the *Makhzan* describes it as cold and dry, cardiacal, tonic, astringent, alexipharmic, antaphrodisiac, a resolvent of inflammatory swellings, &c. He recommends an emulsion in bilious fever, on account of its cooling and protective influence over the heart, brain, stomach, &c. As an external application a paste made with rosewater and camphor, or with sarcocolla and white of egg, may be applied to relieve headache, or to any kind of inflammatory swelling or skin affection. Sometimes the paste is made with the juices of herbs, such as purslane, nightshade, &c. Ainslie states that in Southern India sandalwood given with milk is regarded as a valuable remedy in gonorrhœa. Rumphius (ii., p. 42) mentions a similar use of it at Amboyna. In the Concan sandalwood oil with cardamoms and bamboo manna is given in gonorrhœa, and mixed with limejuice and camphor it is used as a cooling application to eruptions, &c. A conserve of sandalwood is also made by boiling the wood cut in small pieces in bangar-khár (impure carbonate of potash) and water (4 seers sandal, half a seer bangar-khár, and 32 seers water), until it is quite soft. It is then preserved in a thick syrup. Sandalwood was known to the Greeks from the time of Alexander. Arrian mentions ξύλα σαγαλίνα among the Indian imports into Oman in the Persian Gulf. Constantinus Africanus, a physician of the School of Salerno, appears to have been the first to use it medicinally in Europe. In the *Pharmacopœia of India*, Dr. Æ. Ross is stated to have subjected the wood to trial, and found that whilst its effects as a stimulant were very slight, its

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secondary effect was that of a sedative on the circulation. In remittent fevers in which it was administered, it acted as a diaphoretic, diminishing at the same time the rapidity rather than the violence of the heart's action. Dr. Henderson, of Glasgow, and, in France, Drs. Panas, Gubler and Simmonet, have directed the attention of European physicians to the valuable properties of the oil as remedy for gonorrhœa, in doses of from 30 to 40 minims three times a day, and there is now some demand for it in India for this purpose.

Dr. Henderson asserts that he always found it inoffensive, even in strong doses; that at the expiration of forty-eight hours complete relief is effected; besides, it has the important qualification of pleasing the patient and being agreeable to the stomach; it is superior to copaiba and cubebs, succeeding where the latter have failed, and with a delicate subject it is to be highly valued as a remedy uniting a real stomachic to a great specific action, and that, in short, during the last five years, he is indebted to it for a great number of successful cases. (*Medical Times and Gaz.*, June 1865.) In a communication to the Paris Chirurgical Society, Dr. Panas (1865) equally advocated its use. Oleum Santali has also been prescribed in chronic catarrh of the bladder, where it performs the same offices as oil of turpentine, without its injurious effect on the kidneys and alimentary canal. In all cases it is best administered in the form of Midy's Capsules, ten to twelve of which may be given daily at first, divided into three doses, each of which may be taken a quarter of an hour before meals; the number of capsules taken daily may be gradually increased to 24, but as soon as the discharge becomes serous, the dose should be gradually diminished. M. C. Méhu has observed that after the internal administration of oil of sandalwood, a resinous substance is found in the urine having the odour of the wood, which appears to be kept in solution by phosphate of soda, and which has the properties of a very weak acid. This resinous substance can only be obtained in very small quantities by shaking the urine with ether; to obtain it in larger quantity, an acid must be used (phosphoric or tartaric), which makes the urine turbid from separation of the resinous matter. If the urine

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is now shaken with ether, and the ether evaporated, the resinous matter is obtained of a light-brown colour, and having the odour of sandalwood. This substance in contact with concentrated sulphuric acid affords the same yellow-brown and red colours as pure oil of sandalwood. M. Méhu has also observed that the pure sandal oil does not communicate a violet odour to the urine, as is the case when the oil is adulterated with copaiba and turpentine. (*Journ de Pharm. et de Chim.*, Sept. 1st, 1886.) The fact of a resin being precipitated by acids from the urine in cases in which sandalwood oil has been administered, has therefore to be remembered in testing for albumen with nitric acid.

Description.—Sandalwood logs are about a yard in length and 5 to 6 inches in diameter; they are stripped of the bark and a portion of the sapwood. Andreas Petersen of Copenhagen, who made in 1886 a very careful investigation of the wood, says:—"It is very homogeneous, rather hard and ponderous, although it does not sink in water. The heartwood is pale reddish, with darker reddish-brown and brighter yellowish concentric zones, which, when examined under the microscope, prove to be annual rings. In the inner part of the wood they are sometimes very wide, measuring, for instance, as much as seven millimetres. Possibly, therefore, they do not correspond to one year's growth, but to that of a longer period.

"The transverse section, examined by means of a lens, displays the numerous narrow medullary rays; the vessels are partly empty, partly loaded with yellow resin. In the bright yellowish sapwood both vessels and medullary rays are less distinct. The sapwood is scentless, whereas the heartwood, especially when freshly cut, is in a high degree possessed of the very agreeable and remarkably persistent odour of sandal oil.

"The miscroscope shows the prevailing part of the tissue of the wood to be made up of ligneous fibres (libriform), the thick walls of which are marked with small annular pits (behöfte Tüpfel). The woody tissue is traversed by medullary rays consisting of

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one or two rows of somewhat irregular cells. On a transverse section, the distance of the medullary rays from each other is very different. According to the size and position of the vessels, the medullary rays are somewhat undulated. Most of the vessels are very large, the largest as much as 89 mkm. in diameter. They are very regularly distributed, either isolated, or in groups of two or three, very seldom more. Their walls are very thick, being marked with numerous annular pits, communicating with those of the surrounding cells. There is also to be met with in the wood, parenchymatous tissue to some extent, which is made up either of isolated cells or of short tangential or oblique rays of two to five cells; these parenchymatous layers very seldom run from one medullary ray to another. Crystals of oxalate of calcium are also found; and in longitudinal sections they are seen to be enclosed in long ducts, containing each 10—15 crystals. As to the concentric zones of darker and brighter tint, as mentioned above, the vessels of the latter zones are much smaller and less numerous than those of the dark ones; the libriform cells likewise show the same difference, although less distinctly. Thus the dark zones in all probability represent the wood built up in spring. The vessels have an average diameter of 74 mkm., those of the vessels in the other rings being only 47 mkm.

"The darker colour is due partly to the actual cell-walls, partly to the resin contained in numerous vessels. On the whole, the concentric markings or zones are more distinct to the naked eye than under the microscope. On a vertical section the medullary rays are seen to be built up of usually less than eighteen layers, each consisting of two or three rows of cells. The position of the medullary rays and pits does not allow this wood to be classed among the woods which were described by Höhnel as showing the remarkably regular arrangement of layers or series like stories, which he termed a 'stockwerkähnliche' structure. If these slices of the wood are boiled for some minutes with nitric acid (1·185), a little chlorate of potassium being added, the single cells are easily isolated. The libriform cells are then distinctly seen to exhibit the typic form alluded to above, a few

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of them reminding one extremely of the fibres, of which the pinewood is made up. I have also noticed intermediate fibres, marked with both true annular and laterally extended pits (Hoftüpfel and Spalttüpfel). The vessels are short, somewhat obliquely truncated, and perforated with a great annular hole, the ends of the vessels being more or less pointed.

"Only the heartwood is valuable, the sapwood and branches being not used. I failed, in fact, in demonstrating the presence of oil in the sapwood, the tissue of which is nearly colourless, and exhibits no contents at all in its cells. In the heartwood, on the contrary, the cell-walls are very rich in yellow colouring matter. The parenchymatous part of the wood, the medullary rays and numerous vessels are loaded with a yellow-brownish resinous matter. Thin slices, examined under water or glycerine, display a great many smaller and larger drops, soluble in alcohol and reducing osmic acid (1 part dissolved in 100 parts of water); no doubt they are drops of essential oil. These drops, flowing out of the ducts, on thin sections are seen most abounding along the primary membranes of the cells and in their pits. But if rather thick sections are treated with osmic acid, the woody parenchyme and the medullary rays also assume a black colour, due to reduced osmium. If, on the contrary, the sections, before being treated with osmic acid, have been well washed with alcohol, the just mentioned parenchyme is not at all or but extremely faintly blackened. The cells under notice contain no tannic matter, as shown by means of bichromate of potassium and chloride of iron, the reduction of the osmic acid is consequently not due to tannic matter. Small pieces of the heartwood were further treated for some days with a solution of osmic acid, then extracted by means of alcohol and dried. When sections were made from these pieces, I ascertained that nearly all the parenchymatous parts had assumed a black colour. Sometimes also the libriform cells contain a small amount of oil, but the experiments just mentioned prove the *parenchymatous tissue of the wood to be the principal seat of the essential oil.* When treated with a mixture of equal parts of

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glycerine and solution of potash (5 per cent.), oil drops are also distinctly seen in the parenchyme. I ascertained that there is no corky membrane in the walls of these cells, like that occurring in many other cases. From a physiological point of view, the absence of corky walls of the cells of the heartwood might be expected." (*Pharm. Journ.* (3), xvi., 757.)

Chemical composition.—The wood treated with boiling alcohol yields about 7 per cent. of a blackish extract, from which a tannate is precipitated by alcoholic solution of acetate of lead. Decomposed by sulphuretted hydrogen, the tannate yields a tannic acid having but little colour, and striking a greenish hue with a ferric salt. The extract also contains a dark resin. (*Pharmacographia.*) The most interesting constituent of sandal-wood is the fragrant essential oil. It is a yellowish, remarkably thick liquid, having a high specific gravity (usually more than 0·960); and is a mixture of hydrocarbons and oxygenated oils, boiling at a very high temperature. The specific gravity of a pure sample of oil distilled at Hunsur from the roots was 0·9745 at 15°·5. M. Chapoteaut (*Bull. Soc. Chim.*, xxxiv., 303) has shown that it is composed of two oils, one boiling at 300° and the other at 310°, and that the composition of the oil boiling at 300° is $C^{15}H^{24}O$, and of the oil boiling at 310° $C^{15}H^{26}O$. This chemist has been able to obtain with the latter oil a series of ethers under the influence of the different acids he brought to act upon it, and has announced the important fact that the oil $C^{15}H^{26}O$ is an alcohol, the aldehyde of which is the oil $C^{15}H^{24}O$. Phosphoric anhydride absorbs water from both, converting them into hydrocarbons of the formulæ $C^{15}H^{22}$ and $C^{15}H^{24}$, respectively. By the Indian process only 2·5 per cent. of oil is obtained from the wood, but the powerful apparatus of Messrs. Schimmel & Co. of Leipzig affords as much as 5 per cent.

Collection and Commerce.—Mr. C. E. M. Russell, Superintendent of Forests in Mysore, in a Report upon sandalwood (1889), says:—" Sandalwood is the most important source of Forest

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revenue in Mysore. It is a monopoly of the Mysore Government, and, except by Government Agency, no sandal tree can be uprooted or cut down even upon land which is private property. The only exceptions are the Jahgirdar of Yelandur and the Guru of the Sringeri Matt, who are permitted to cut and dispose of the sandalwood of their own Jahgirs. The tree is plentiful in the Mysore country, and occurs also, but in far less quantities, in those portions of the Madras territóry which border upon Mysore; for practical purposes, however, Mysore may be said to almost hold the monopoly of the sandal supply. It is a somewhat delicate tree, is killed outright by fire, is very impatient of injuries to the roots and bark, and requires shade and protection while young. The value of the wood is dependent upon a volatile oil which is contained in the heartwood only, and in order that this oil may be developed in the highest possible degree, it is necessary that the growth of the tree should be slow, consequently sandalwood grown in arid situations on poor stony soil is, though small, of far more value than is that produced by large well-grown trees growing in moist situations and in richer soil. The maturation period of the sandal tree is variously stated at from 40 to 60 years. Sandalwood is not eaten by white ants, and its contained oil preserves it from decay in a remarkable degree, of which the present collection of old sandal roots left in the ground for many years past is a conclusive proof. In former times it was the custom not to uproot, but to fell, sandal trees, whereas for many years past the trees have been uprooted, and the roots, which contain a higher percentage of oil than the wood, are in great demand and command high prices.

"Even in periods of depression of the sandal market, a fair demand for roots has always been noticeable. The method of preparation is as follows:—

"The trees having been uprooted are roughly deprived of bark and of some of the sapwood on the spot, and are then carted into the nearest of the sandal Kothis, of which nine exist in the Mysore Province.

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"The distribution of the various sandal Kothis and their names are:—

District.	Number of Kothis.	Names
Mysore..........................	2	Hunsur and Seringapatam.
Bangalore..........................	1	Bangalore.
Shimoga	4	Shimoga,
		Tirthahalli,
		Anantapur, and
		Shikarpur.
Hassan..........................	1	Hassan.
Kadur	1	Chikmagalur.

"On arrival at the Kothis, the trunks are sawn off above the roots, cut into lengths, all the white wood removed, the billets adzed and subsequently planed and smoothed, the roots adzed and freed of all adhering bark, mud, and white wood, and the various products—billets, chips, small pieces, hollow wood, saw powder, &c.—collected and classified according to the classes represented by the specimens forming the sandal trophy. About the months of November and December auction-sales of the various classes are held in all the Kothis of the Province, and are so arranged, as regards the dates fixed for holding the same, that purchasers may, if they choose, attend the sales in Shimoga, Kadur and Hassan, and yet be in time for those in Mysore and in Bangalore.

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"*Range and Yield of, and Revenue derived from, Sandalwood.*—The range, yield of wood, and the revenue derived therefrom can conveniently be shown in tabular form. The statements below contain the figures for 6 years:—

Years.	Mysore.			Shimoga.			Bangalore.			Hassan.			Kadur.		
	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.
	Tons.	Tons.	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.
1882—83......	574	260	96,377	817	849	2,70,716	141¼	39½	17,049	185½	162¼	47,180	225	124	39,644
1883—84......	217¾	308¾	73,728	806	845	2,71,626	108	¾	615	241¾	211½	70,550	115½	90	20,220
1884—85......	309	393½	1,15,032	884½	140	75,643	1¼	228¼	52,595	260½	193¾	63,489	68½	48¼	12,954
1885—86......	261½	454	1,57,308	231¼	530	1,79,439	182	158½	38,405	227½	274¾	94,218	78¾	145¾	45,492
1886—87......	521½	493¾	1,46,367	396¾	754½	2,53,471	113	164	63,604	187¼	194	71,490	166	203½	75,480
1887—88......	940½	866¾	2,28,215	798¾	835¼	2,53,893	184	159¾	56,811	230¾	254¾	95,245	211¾	144½	47,281
	2,824¼	2,776¾	8,17,027	3,934¾	3,993¾	13,04,788	729½	753¼	2,29,079	1,333¼	1,291	4,43,172	855½	756	2,41,071

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Average Summary calculated on the 6 years.

District.	Collection.	Sold.	Revenue.	Average rate per ton sold.
	Tons.	Tons.	Rs.	
Shimoga District......	660⅔	666	2,17,465	326⅓
Mysore do.	470⅔	463	1,36,171	294
Hassan do.	222½	215	73,862	343⅓
Bangalore do.	121⅔	125	38,180	305½
Kadur do.	144¼	126	40,178	319

Years.	Collection.	Sold.	Revenue.	Average rate per ton sold
	Tons.	Tons.	Rs.	
1882—83	1,942¾	1,434¾	4,70,966	328¼
1883—84	1,489	1,456	4,36,739	300
1884—85	1,523¼	1,043¾	3,19,713	306¼
1885—86	1,011	1,563	5,14,862	329⅓
1886—87	1,384½	1,809¾	6,10,412	337¼
1887—88	2,365¾	2,261	6,82,445	302
	9,716¾	9,568¼	30,35,137	317

"Thus, the revenue from sandalwood in 1887-88 amounted to no less than Rs. 6,82,445, while the average revenue for the 6 years reaches Rs. 5,05,856.

"There is but a slight variation between the prices obtained for the various classes of sandal at the sales held in the various Kothis of the Province, so the prices obtained last year in the Mysore District, though somewhat lower than those obtained in certain other Districts, will afford a fair idea of the value of the different classes.

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"Rates obtained in auction in the Mysore District in December 1887 :—

	Rs. per ton.
1st class (selected logs)	514
2nd class (do)	496
3rd class (do)	485
4th class (do)	487
5th class (logs)	471
Roots	383
Jajpokal (ordinary commercial)	352
Bagaradad (do. inferior)	372
Powder	322
Ain Bagar (inferior wood)	311
Ain Chilta (common chips)	187
Hutri Chilta (coarse do.)	168
Basola Bukni (adzed do.)	47
Milva Chips (mixed do.)	85

"The yield of sandalwood from the Mysore Province is capable of expansion. Until recently little attention was paid to artificial reproduction and the encouragement and artificial enhancement of natural reproduction, the supply being obtained solely from natural growth. Now, however, extensive measures, having for their object Sandal reproduction throughout the Province, are being carried out, and no practical limit to the possible supply of this valuable tree, beyond the necessary question of demand, is conceivable.

"*Chief Markets for Sandalwood.*—It will be matter for surprise that so valuable a wood, and one of which a single Province may almost be said to hold the monopoly, should be so little known outside India.

"The fact is that the trade in Mysore sandalwood has hitherto been confined to a ring, consisting chiefly of Muhammadan Seits, who either as principals or as agents of Bombay Firms, attend the local sales and send the sandalwood purchased by them to Bombay. The transit to Bombay from the coast is by sea in native craft. The Railways might perhaps secure this traffic if they offered special rates.

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"The carts that convey the sandalwood to the coast are hired at low rates, as they are certain of return loads of salt and other merchandise to Mysore. Until recently, nearly all the sandalwood sold in the auctions held by the Mysore Government, went to Bombay, but a demand having lately arisen for sandal oil for medicinal purposes, some direct shipments of wood for extraction of oil to France and Germany, and, probably, also to America, have been made."

A small quantity of sandalwood is produced in the Madras Presidency, and in the Bombay districts of North Canara and Dharwar. The following figures show the revenue obtained from the wood in the Madras districts in 1889-90:—

North Arcot......	Rs. 5,688	Average price, Rs. 4	per cwt.
South Arcot......	,, 1,385	,, ,, ,, 15	,,
Salem	,, 5,679	,, ,, ,, 15	,,
North Coimbatore	,, 194	,, ,, ,, 12	,,
Nilgiris	,, 5,616	,, ,, ,, 13	,,
Total......	18,562		

Statement of Sandalwood collected in the North Canara and Dharwar Districts in 1889-90 *and sold by auction at Kumpta.*

No.	Class of Sandalwood.	No. of billets.	Quantity.			Rate.			Amount.		
			K.	m.	lb.*	Rs.	a.	p.	Rs.	a.	p.
1	1st class	363	18	7	20	142	4	8	2,616	2	2
2	2nd do.	472	13	3	19	140	1	7	1,847	0	9
3	3rd do.	436	7	0	2	136	6	11	955	8	10
4	4th do.	933	12	0	10	138	6	8	1,663	7	5
5	5th do.	546	4	0	11	133	0	0	534	9	11
6	6th do.	1,424	5	0	6	120	0	0	601	4	7
7	Roots	1,056	9	12	26	130	0	0	1,254	0	6
8	Jajpokal	53	1	0	0	114	0	0	114	0	0
9	Small pieces..........	721	0	10	9	75	0	0	38	11	4
10	Trimmings Bags	38	3	7	16	38	0	0	128	6	2
11	Sawdust do.	3	0	4	17	90	0	0	20	11	9
12	White wood	573	8	7	7	16	0	0	133	12	9
	Total......	......	82	15	3	....			9,907	12	2

* The Bombay kandy of 20 maunds of 28 lbs.

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In 1889-90 the total quantity of sandalwood offered for sale in Mysore was 2,384 tons, 3 cwts., 63 lbs. Of this quantity only 2 tons, 16 cwts., 105 lbs., were placed in the first class. The total revenue yielded was Rs. 8,82,031.

The quantities sold at the different Kothis were—Hunsur Kothi, 673 tons, 13 cwts., 58 lbs.; Seringapatam Kothi, 439 tons, 11 cwts., 28 lbs.; Hassan Kothi, 180 tons, 9 cwts., 28 lbs.; Chikmangalur Kothi, 132 tons, 14 cwts., 70 lbs.; Jirthahalli Kothi, 233 tons, 13 cwts., 48 lbs.; Shimoga Kothi, 471 tons, 14 cwts., 6 lbs.; Shikapur Kothi, 252 tons, 7 cwts, 49 lbs. Of the 673 tons, 13 cwts., 58 lbs. offered for sale at Hunsur Kothi, only 148 tons, 4 cwts., 28 lbs., consisted of logs, which were classified as follows:—

	Tons.	cwts.	lbs.	Price given.
1st class	...	10	28	Rs. 601 per ton.
2nd ,,	6	5	84	,, 596 ,,
3rd ,,	60	4	84	,, 575 to 582 per ton.
4th ,,	21	3	56	,, 570 to 574 ,,
5th ,,	6	...	...	,, 554 ,,

The roots fetched prices ranging from Rs. 416 to Rs. 449, the sawdust Rs. 420, and the chips and trimmings from Rs. 70-8 to Rs. 301.

Sandalwood oil.—The Mysore Government has long had establishments for extracting the oil, which is sold at the annual auction along with the wood, and chiefly bought up for exportation to China and Arabia. It is procured from the wood by distillation, the roots yielding the largest quantity and finest quality of oil. The body of the still is a large globular clay pot with a circular mouth, and is about 2½ feet deep by 6½ in circumference at the bilge. No capital is used, but the mouth of the still, when charged, is closed with a clay lid having a small hole in its centre, through which a bent copper tube about 5½ feet long is passed for the escape of the vapour. The lower end of the tube is conveyed inside a copper receiver, placed in a large porous vessel containing cold water. When preparing the sandal for distillation, the white or sap wood is rejected, and the

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heartwood is cut into small chips, and distillation is slowly carried on for ten days and nights, by which time the whole of the oil is extracted. As the water from time to time gets low in the still, fresh supplies are added from the heated contents of the refrigerator. The quantity of oil yielded by wood of good quality is at the rate of 10 ozs. per maund, or 2·5 per cent. It is transparent and of a pale yellow colour, and has a resinous taste and sweet peculiar smell, which is best appreciated by rubbing a few drops of the oil on the warm hand. Its specific gravity is about 0·980. (*Bidie.*) The average price in India is about Rs. 8 per lb.

From Mr. Russell's report we learn that recently Messrs. F. Smith, of Bangalore, and W. F. Petrie Hay, of Hunsur, have, with permission, been making experimental distillations. Their samples were clear and good, but it has been brought to notice that the use of iced-strainers would be necessary to prevent the oil becoming thick or cloudy when exported to colder regions.

False Sandalwoods of Eastern Commerce.—The wood of **Santalum Preissii** (South Australian sandalwood) is dark-brown in colour, with unusually close tenacious texture, and extraordinarily hard and heavy. It is much sought for in China, where the oil is used for medicinal purposes and to perfume soaps. Messrs. Schimmel & Co. distilled 75 kilos of the wood and obtained 3 kilos, 800 grams, of oil. The wood, therefore, is one of the richest sandalwoods for oil. In many respects the latter is characteristic and interesting; it is viscid, of a cherry-red colour, and specifically heavier than water. At 15° C. its sp. gr. is 1·022. The oil possesses the property of solidifying at medium temperatures and separating acicular crystals, so that in the process of distillation the cooling must be very carefully effected, otherwise the condensing tubes become blocked. This phenomenon occurs especially in the medium fractions of the oil. The rasped wood has an agreeable balsamic odour with a suggestion of rose oil which is not perceptible in the normal oil. By separating the oil into a number of fractions, the rose odour can be recognised in some

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of the middle fractions. (*Berichte von Schimmel & Co.*, 1891.) The wood of **Santalum cignorum** (West Australian sandalwood) has a sharp odour which distinguishes it from true sandalwood. The oil, which has the same peculiarity, has a sp. gr. of 0·953, rotation +5° 20.

African Sandalwood (botanical origin unknown) is reddish-brown in colour, and very hard and close. Distilled with water it yields 3 per cent. of a ruby-red oil having the consistence of true sandalwood oil. Its sp. gr. at 15° C. is 0·969. The odour resembles that of West Indian sandal oil. (*Berichte von Schimmel & Co.*, 1891.) This wood is largely imported into Bombay; a sample kindly supplied by Messrs. Schimmel & Co. was found to agree exactly with that sold in the bazaar. It is used in India as a cheap substitute for true sandalwood.

EUPHORBIACEÆ.

EUPHORBIA PILULIFERA, *Linn.*

Fig.—*Jacq. Icon.*, *t.* 478; *Burm. Thes. Zeyl.*, *tt.* 104–105, *f.* 1.

Hab.—Throughout the hotter parts of India. The herb.

Vernacular.—Dudhi (*Hind.*), Bara-keru (*Beng.*), Goverdhan, Mothidudhi, Nayeti (*Mar.*), Dudheli (*Guz.*), Amumpatchai-arissi (*Tam.*), Bidari, Nánabala (*Tel.*), Gentikasa, Barasu (*Can.*).

History, Uses, &c.—This plant is not mentioned by Hindu medical writers, nor does there appear to be any Sanskrit name for it. It is known, however, as a popular remedy for worms, bowel complaints, cough and gonorrhœa, and as a local application for the cure of ringworm, the Marathi name *Nayeti* signifies ringworm. Ainslie (ii., 99) remarks:—"If we may believe Piso (*De Med. Brazil*), and Barham (p.180), it possesses most extraordinary qualities, such as a few drops of the juice

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of it killing serpents; its efficacy in venereal complaints and dry bellyache; and its being an antidote to poisons."

Recent investigation has, however, thrown more light upon the properties of the plant. Marsset has discovered that it kills small animals by paralysing the respiration and the heart, through its direct action on the respiratory and cardiac centres. The active principle is eliminated by the liver, for in all the animals which died during the experiments the gall-bladder was found to be distended with bile. He has published excellent results obtained with it in the dyspnœa of asthma, emphysema and bronchitis, these good results depending upon a particular modification of the functions of the pneumogastric. (*Contrib. à l'étude bot. phys. et thérap. de l'Euphorb. pil.* Paris, 1884.) Tison and Beaumetz obtained very satisfactory results from it in dyspnœa of cardiac origin. It appears to act beneficially upon spasmodic dyspnœa, from whatever cause arising, and it unquestionably is a remedy of great power and promise. (*Whitla.*) Its action is not cumulative. The active principle being soluble in water and dilute alcohol, an abundant watery vehicle should therefore be employed. An extract made with water or weak spirit keeps well. In decoction, 1 oz. of the fresh plant or ½ oz. of the dried plant may be used with 2 quarts of water, and be reduced by simmering to one quart; the addition of 1½ to 2 ozs. of alcohol will prevent it from spoiling in a cold climate, but in India the decoction should be made fresh every 2 days. The extract may be given in 1 grain doses, dissolved in syrup or water; it should not be prescribed in pill, on account of its irritant action on the gastric mucous membrane. The decoction is given in doses of a wine-glassful three or four times a day; both preparations are best given after meals or immediately before them. Attention has been redirected to this drug, as of value in the treatment of hay asthma and coryza, by Dr. Rosecrans Workman (*Therap. Gaz.*, July 15, 1890), who states that in thirteen cases of hay asthma, prompt relief was obtained in nine, in one of the other cases partial relief was obtained, and in the remaining three cases the results were negative. The fluid extract was administered in doses of 30 to 60 minims every

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four hours. In nearly all the above cases iodide of potassium and arsenic had been previously used. In nine cases of coryza, good results were obtained in six, the sneezing and rhinal flow ceasing or diminishing within thirty-six hours after the administration of the drug was begun. The doses were repeated every three or four hours. In five cases of asthma of frequent recurrence and long standing, marked relief was experienced in one case: the dyspnœa soon disappeared and the attacks were always shortened. In the other four cases no good effects were obtained.

Description.—Annual, hairy, obliquely-erect, with the apices recurved; leaves opposite, obliquely-oblong, serrulate; flowers small, numerous, in globular, axillary, shortly-peduncled clusters; seeds ovoid. The acute leaves, hispid hairiness, and small fruit render this species easily recognizable.

Chemical composition.—The plant has been examined by J. H. Bunting (*Amer. Journ. Pharm.*, 1888, 552), whose analysis shows the presence of the following constituents: wax, caoutchouc, chlorophyll, resin, tannin, sugar, mucilage, carbohydrates, albuminoids, calcium oxalate, and other salts.

Nothing is known of the active principle beyond the facts that it is soluble in water and weak spirit, and insoluble in alcohol of 90°, ether, chloroform, bisulphide of carbon and oil of turpentine; it is supposed to be a gum-resin. The watery solution on evaporation to dryness leaves a deep reddish-brown substance, having a vitreous fracture, hardly any taste and a strawberry odour. (*Bardet et Egasse, Form. des Nouv. Remèdes,* Paris, 1886.)

EUPHORBIA THYMIFOLIA, *Burm.*

Fig.—*Burm. Thes. Zeyl., t.* 105, *f.* 2; *Rheede, Hort. Mal. x., t.* 33.

Hab.—Throughout India and Ceylon, Central Asia, and all hot countries, except Australia.

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Vernacular.—Chhoti-dudhi, Nigáchúni (*Hind.*), Rakta-keru, Dudhiya (*Beng.*), Chin-amam-patchai-arissi, Sittrapaládi (*Tam.*), Bidari-nána-biyyam (*Tel.*), Dákti-dudhi, Lahan-nayeti (*Mar.*), Dodhuk, Hazárdána (*Punj.*).

History, Uses, &c.—This plant is not mentioned in the standard Sanskrit medical works, but, along with the allied species *E. granulata*, Forsk., *E. microphylla*, Heyne, and *E. Clarkeana*, Hook *f.*, which the natives do not distinguish from it, it is used medicinally in most parts of India and the East. The author of the *Khulásat-el-tajárib* states that it is a small milky prostrate plant with slender reddish stems, and opposite leaves about the size of a split lentil seed, very common about Merv in sandy ground. It is hot and dry in the first of the third degree; the expressed juice or powdered plant with wine is given as a remedy for the bites of venomous reptiles, and is applied externally to the bitten part; with milk it acts as a purgative and expels all noxious humors from the body. According to Ainslie, the Sanskrit name is Rakta-vindu-chhada, which would imply that it is a remedy for *Rakta-vindu*, "gonorrhœa with sanious discharge." He remarks:—"The very small leaves and seeds of this low-growing annual plant, which, in their dried state, are slightly aromatic and a little astringent, are given by the Tamool doctors, in worm cases, and in certain bowel affections of children; they are commonly administered in the form of powder, and in buttermilk, to the quantity of one pagoda and a quarter weight in the course of the day on an empty stomach. The leaves when carefully dried smell something like tea." (*Mat. Ind.*, ii., 75.) Irvine states that it is used as a stimulant and laxative in Northern India. In the Concan the juice is used to cure ringworm, and mixed with chloride of ammonium for the cure of dandriff. O'Shaughnessy says that the juice is a violent purgative, and that the fresh plant is, by the Arabs, applied to wounds. In the *Dict. Econ. Prod. of India*, it is stated, on the authority of the Rev. A. Campbell, that the Santals use the root of this plant, which they call Nanha-pusi-toa, as a remedy for amenorrhœa.

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Description.—A much branched annual prostrate plant, more or less hispidly pubescent, leaves opposite, $\frac{1}{6}$ to $\frac{1}{3}$ inch, petioled, obliquely-oblong, obtuse, crenulate, glabrous or pubescent beneath, stipules elongate, involucres subsolitary, very minute, axillary, especially in the crowded terminal branchlets, lobes short ciliate, glands very minute, stipitate; capsules erect, obtusely keeled, pubescent; seeds with 5 to 6 shallow transverse furrows.

Chemical composition.—An alcoholic extract of the whole plant was mixed with water acidulated with sulphuric acid, and successively agitated with petroleum ether and ether, and then reagitated with ether from the solution rendered alkaline with sodic carbonate. The petroleum ether extract contained a large amount of colouring matter; it had a very faint bitter taste; on standing, dark, and what appeared to be crystalline, points separated, but which, on microscopic examination, were destitute of regular structure. Euphorbon was specially sought for, but we arrived at no definite conclusion relative to its presence.

The acid ether extract was of a greenish colour, and partly soluble in water, the solution giving a greenish coloration with ferric chloride, and precipitating gelatine, but giving no reaction with cyanide of potassium.

After washing off by cold alcohol the extractive adhering to the sides of the capsule, and which was insoluble in water, a sulphur-yellow deposit was left, which, on microscopic examination, consisted of very minute needles. This principle was present in only minute traces, and was soluble even in warm alcohol with difficulty; it gave the reactions of quercitrin.

The aqueous original acid solution, before the addition of sodic carbonate, was of a bright claret colour; on the addition of the alkali sage-green flocks separated, the addition of acids causing solution, and reproducing the original claret-coloured solution; but after standing, the flocks became insoluble in acids,

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and only a faintly yellowish-red tint was produced by their addition.

The alkaline ether extract contained an alkaloidal principle which crystallized in fine colourless feathery crystals; it possessed no bitter taste. With Fröhde's reagent in the cold a very faint-yellow tint was produced, which was changed to greenish on gently warming. Concentrated nitric acid gave a yellowish tint. Sulphuric acid and potassium bichromate no colour reaction.

EUPHORBIA TIRUCALLI, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 44. Milk-bush (*Eng.*), Euphorbe antivenérien (*Fr.*).

Hab.—Africa. Cultivated in India and the East. The juice and bark.

Vernacular.—Bár-ki-thohar, Bár-ki-sehund (*Hind.*), Káda-nivali (*Mar.*), Netrio-thora, Thora-dánadálio (*Guz.*), Kalli-kombu (*Tam.*), Káda-jemudu (*Tel.*), Bonta-kalli, Káda-nevali (*Can.*), Tiru-kalli (*Mal.*), Lanka-sij (*Beng.*).

History, Uses, &c—This shrub has been introduced into the East from Africa, and is much used for making fences round cultivated fields, as cattle will not break through it owing to the acrid nature of the milky juice. The earliest notice of *E. Tirucalli* that we know of is in the *Kámus,* which was written about the middle of the 14th century; it is there called دحن (dihan), the name by which it is still known in Arabia (*Forskahl*), and is described as a noxious plant, used to poison wild beasts. The plant is not mentioned in the Nighantas, but the juice is in general use among the natives of India as a purgative, and, applied locally, as a counter-irritant. Rheede states that a decoction of the root is given in certain cases of colic, and that the milky juice mixed with melted butter is prescribed as a purge. It is the *Ossifraga lactea* of Rumphius, who says that the bark is applied in Java to fractures. According to Horsfield, the Javanese, who call it *Kayoe-oorb,* also use

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it as a vesicant. Virey (*Hist. Nat.*, p. 299) says :—Il guérit très bien l'affection venérienne ; il est aussi purgatif et vomitif." Loureiro notices its caustic nature: "Occulos si tangat excæcat." (*Ainslie, Mat. Ind.*, ii., 133 and 425.) In the Concan 1 to 4 drops of the milky juice are given with treacle or the flour of *Cicer arietinum* as a purge, and the charcoal, which is very light, is used in making pastilles. Dr. G. Y. Hunter speaks of the juice as a good application in neuralgia. In Goa it is used for poisoning fish.

Description.—A shrub or small tree, 15—20 feet, with numerous slender branches, smooth, and of a bright-green colour, having a few, most minute leaves at the extremities, which soon fall off; as the plant grows older, the stalks become stronger, and at length woody and of a brown colour. The wood of old trees is white, close-grained and strong; it produces a good charcoal for gunpowder and other purposes.

Chemical composition.—See next article.

EUPHORBIA NERIIFOLIA, *Linn.*

Fig.—*DC. Plant. Grasses, ii.*, *t.* 46; *Rumph. Herb. Amb. iv.*, *t.* 40.

Hab.—Deccan Peninsula, Beluchistan, Malay Islands. Cultivated elsewhere. The juice and root.

Vernacular.—Sehund, Thohar (*Hind.*), Mansa-sij, Páta-sij (*Beng.*), Nevadunga, Mingút (*Mar.*), Thohar-kántáro (*Guz.*), Ilaik-kalli (*Tam.*), Áku-jemudu (*Tel.*), Yale-kalli (*Can.*), Elak-kalli (*Mal.*).

EUPHORBIA ANTIQUORUM, *Linn.*

Fig.—*Wight Ic.*, *t.* 897; *Rheede, Hort. Mal. ii.*, *t.* 42.

Hab.—Throughout the hotter parts of India and Ceylon. The juice and root.

Vernacular.—Tidhára-sehund (*Hind.*), Tekáta-sij (*Beng.*), Tridhári-nevadunga, Nara-seja (*Mar.*), Shadhurak-kalli (*Tam.*),

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Bomma-jemudu (*Tel.*), Mudu-mula-kalli (*Can.*), Katak-kalli (*Mal.*), Tandhári-thohar (*Guz.*).

History, Uses, &c.—These two plants are included under the Sanskrit names of Snuhi, Sehunda, Vajra, Vajra-tundi, Vajra-dantaka, Gandira and Maha-taru, and are supposed to ward off lightning strokes, on which account they are sometimes cultivated in pots placed on exposed positions in Hindu houses. They are sacred to Mansá, the goddess of serpents. In some parts of India, in July and August, on Tuesdays and Thursdays, the natives approach the trees with offerings of rice, milk, and sugar, praying to be delivered from snake-bites. They also employ the root mixed with black pepper as a medicine for the cure of snake-bites internally and externally. Dutt informs us that in Bengal, on the fifth day after the full moon of the month Srawan, *E. neriifolia* is planted in the court-yard of Hindu houses and worshipped.

In Western India there is a curious custom among the Concani Brahmins in connection with this plant. At the time of the Dewali they cut a portion of the stem, hollow it out, and fill it with oil, in which they place a wick. The little lamp thus formed is lighted and carried from house to house with the object of depositing it unextinguished in the house of some friend or acquaintance, saying at the same time, "A son-in-law for you," that is, wishing them good fortune (Nevadunga). The people of the house pretend not to want it, and try to extinguish the light by throwing water at it. These lamps are also placed upon little heaps of cowdung and worshipped.

In the Nighantas the plants are described as purgative, pungent, digestive, bitter and heavy, and are said to be useful in constipation, flatulent distention, tumours, swellings, abdominal enlargements, rheumatism, spleen, leprosy, mania and jaundice.

They abound in an acrid milky juice, which is a popular application to warts and other cutaneous affections. The native doctors purify arsenious acid by packing it in a hole

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made in a piece of the stem, closing the hole and exposing the stem to the action of fire until it is charred. The milky juice of *E. neriifolia* is usually administered internally by soaking other purgatives and aromatics in it, so that by absorption of the juice their purgative properties become increased. A similar method is adopted when the juice is applied externally, a tent or issue pea being prepared with some finely powdered drug and steeped in it. Ainslie tells us that the native practitioners prescribe the juice as a purge and deobstruent, in those visceral obstructions and dropsical affections which are consequent of long-continued intermittent fever, the quantity given for a dose being about ½ of a pagoda weight (20 grs.). Externally, mixed with margosa oil, it is applied to limbs which have become contracted from rheumatism. (*Mat. Ind.*, Vol. II., p. 97.) In Bombay the root is mixed with country liquor to make it more intoxicating, and the juice is used to kill maggots in wounds, and is dropped into the ear to cure earache, a practice common to many parts of India. In the Concan the stem is roasted in ashes, and the expressed juice, with honey and borax, given in small doses to promote the expectoration of phlegm; sometimes the juice of *Adulsa* is added. For asthma, *Mudar* flowers, *Aghada* root, and *Gokaran* root are steeped in the juice, powdered and given with honey and chebulic myrobalans. Dose about 4 grains. The author of the *Makhzan-el-Adwiya*, under the name of Zakúm (Euphorbia), describes four Indian species, which are probably *E. antiquorum*, *E. neriifolia*, *E. Nivulia* and *E. Tirucalli*. The milky juice of the first, he says, is mixed with the flour of *Cicer arietinum*, roasted, and administered in pills as a remedy for gonorrhœa. It has a strong purgative action. The juice of the second and third species is heated and dropped into the ear for the cure of earache; heated with salt it is given as a remedy in whooping cough, asthma, dropsy, leprosy, enlarged spleen, dyspepsia, jaundice, flatulence, colic, calculus, tumours, &c. The fourth species yields a milky juice, having similar properties. Sprengel identifies *E. neriifolia* with the ماهودانه (Mahúdáneh) of Ibn Sina, also called Hab-el-mulúk, 'a purgative seed of a reddish

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brown colour and like a vetch.* The author of the جامع jocosely remarks that the name should be ماهو بذاته and says:— اى قايم بنفسه اى انه يقوم بذاته فى الاسهال "it is sufficient as a purgative without the assistance of any other drug." Ibn Sina describes Mahúdaneh as tricoccous and like a large filbert; he says, the name of the plant is Shibáb. It cannot be *E. neriifolia*, which has seeds no larger than a grain of mustard. In the *Dict. of Econ. Prod.*, published by the Government of India, it is stated, on the authority of Dr. J. H. Thornton, that the juice of *E. antiquorum* mixed with burnt borax and common salt is used as an application to painful joints and swellings. Dr. Thornton says:—"The fresh milky juice is a direct irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative." *E. trigona*, Haworth, the Kattimandu or "knife medicine" of the Telugus, so named because it is used for fixing knife blades in their handles, and *E. Nivulia*, Ham., have similar properties.

Description.—*E. neriifolia* is a small, fleshy, glabrous tree or shrub, branches jointed, cylindric or obscurely 5-angled, with short, sharp stipular thorns arising from thick tubercles; leaves deciduous, fleshy, obovate oblong or obovate-acute; involucres in small, stout, dichotomous, short-peduncled cymes from the sinuses, hemispheric, smooth, styles connate high up, undivided, cocci compressed, glabrous; the fruit is tricoccous, but so deeply divided that it has the appearance of three radiating slender follicles. The seed is about the size and shape of a grain of mustard, and of a greyish-brown colour.

E. antiquorum is an erect, fleshy, glabrous tree or shrub, branches terete or obscurely 3—6 angled, branchlets with 3—5 thick sinuate wings, and a pair of sharp stipular thorns in the sinuses; leaves few and small, from the sides of the wings, fleshy, obovate oblong, tip rounded; involucres 3-nate, forming short-peduncled cymes in the sinuses, styles free, 2-lobed, cocci compressed, glabrous.

E. Nivulia and *E. trigona* are very similar shrubs.

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* Hab-el-mulúk is the seed of *Croton Tiglium*.

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Chemical composition.—Henke (*Archiv. d. Pharm.*, Vol. 224 (1886), 729—759) has ascertained that the dried juice of Katti-mandu (*E. Nivulia*) contains 35 per cent. of *Euphorbon*, 25·40 per cent. of resin soluble in ether, 13·70 of resin insoluble in ether, 1·50 per cent. of caoutchouc, and the other constituents of commercial *gum euphorbium*. The dried juice of *E. Tirucalli* was also found to be of a similar nature, and to contain 4 per cent. of caoutchouc. Henke examined the juice of sixteen species of Euphorbia and ascertained that they all contain euphorbon, so that we may fairly suppose it, as well as an acid resin, malate of calcium, and caoutchouc, to be a constant constituent of the milky juice of all the plants belonging to the genus. (*See next article.*)

EUPHORBIA RESINIFERA, *Berg.*

Fig.—*Jackson, Account of Morocco, t.* 6; *Berg. et Sch., t.* 34 d, *f.* M—X; *Bentl. and Trim.* 240.

Hab.—Morocco. The dried juice (Gum Euphorbium).

Vernacular.—Farbiyun, Afarbiyun, Farfiyun (*Ind. Bazars*).

History, Uses, &c.—Euphorbium was known to the ancients. Dioscorides and Pliny both describe its collection on Mount Atlas in Africa, and notice its extreme acridity. According to the latter writer, the drug received its name in honour of Euphorbus, Physician to Juba II., King of Mauritania. This monarch, who, after a long reign, died about A.D. 18, was distinguished for his literary attainments, and was the author of several books, which included treatises on opium and euphorbium. The latter work was apparently extant in the time of Pliny.

Euphorbium is mentioned by numerous other early writers on medicine, as Rufus Ephesius, who probably flourished during the reign of Trajan, by Galen in the 2nd century, and by Vindicianus and Oribasius in the 4th. Ætius and Paulus Ægineta, who lived respectively in the 6th and 7th centuries, were likewise acquainted with it; and it was also known to the

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Arabian school of medicine. In describing the route from Aghmat to Fez, El-Bekri of Granada, in 1068, mentioned the numerous plants of *El-Farbiyun* growing in the country of the Beni Ouareth, a tribe of the Sanhadja. (*Pharmacographia.*) Ibn Sina notices the drug under the name of Farbiyun; Haji Zein states that it is called Farbiyun, Afarbiyun, Farfiyun and Tákúb, and that the men who collect it have to tie up their faces to prevent the dust entering their mouths, as it would cause all their teeth to fall out. He says that as soon as it is collected, it is mixed with husked beans to preserve its strength, and that when fresh it is of a yellow colour, translucent, and easily soluble in olive oil; when old it turns reddish-yellow, the odour is acrid. As regards its medicinal properties, he states that it is a useful application in sciatica, palsy, colic, lumbago, and removes phlegmatic humors from the joints and limbs; internally administered it acts as a purgative of bile and phlegm. However used, it should always be diluted with such substances as oil of roses (fatty extract), bdellium, extract of liquorice, tragacanth or gum arabic; the dose is from one carat to one dang. When given internally to women, it causes abortion, but a pessary containing one grain of euphorbium causes the mouth of the uterus to contract and prevents abortion. Mixed with honey it is used in purulent ophthalmia. Three dirhams is a fatal dose, causing ulceration of the stomach and intestines; the antidotes for it are sour milk, the juice of sour pomegranates, and camphor.

The author of the *Tuhfat-el-muminin* gives almost a literal translation of what Dioscorides says about euphorbium, and reproduces a great part of Haji Zein's account of it; he mentions its use as a snuff, when diluted with beet juice, in certain affections of the brain, as a dusting powder to remove proud flesh, and as an enema in obstructed menses. In modern medicine, euphorbium is never given internally, but it is still sometimes employed as an errhine, after having been largely diluted with some inert powder, in amaurosis, deafness, and other chronic brain diseases. Its use as a counter-irritant is now almost entirely confined to veterinary practice.

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Description.—The drug consists of irregular pieces, seldom more than an inch across and mostly smaller, of a dull yellow or brown waxy-looking substance, among which portions of the angular spiny stem of the plant may be met with. The substance is brittle and translucent, and has a somewhat aromatic odour; it is extremely acrid, and the dust is powerfully irritant if inhaled.

Chemical composition.—An analysis of selected fragments free from extraneous matter by Flückiger (*Vierteljahresschrift fur prakt. Pharm.*, xvii. (1868), 82—102) shows the composition of the drug to be as follows:—

Amorphous resin, $C^{10}H^{16}O^{2}$	38
Euphorbon, $C^{13}H^{22}O$	22
Mucilage	18
Malates, chiefly of calcium and sodium	12
Mineral compounds	10
	100

The amorphous resin is readily soluble in cold 70 per cent. alcohol. The solution has no acid reaction, but an extremely burning acrid taste. By evaporating the resin with alcoholic potash, and neutralizing the residue with a dilute acid, a brown amorphous substance, the *Euphorbic Acid* of Buchheim, is precipitated. It is devoid of acridity, but has a bitterish taste. From the drug, deprived of the amorphous resin ether or petroleum takes up the *Euphorbon,* which may be obtained in colourless, although not very distinct, crystals, which are at first not free from acrid taste, but by repeated crystallizations, and finally boiling in a weak solution of permanganate of potash, may be so far purified as to be entirely tasteless. Euphorbon is insoluble in water; it requires about 60 parts of 80 per cent. alcohol for solution at ordinary temperatures. In boiling alcohol it is freely soluble, also in ether, benzole, amylic alcohol, chloroform, acetone or glacial acetic acid.

Euphorbon melts at 113 to 116° C. without emitting any odour. By dry distillation a brownish oily liquid is obtained,

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which requires further examination. If euphorbon dissolved in alcohol is allowed to form a thin film in a porcelain capsule, and is then moistened with a little concentrated sulphuric acid, a fine violet hue is produced in contact with strong nitric acid slowly added by means of a glass rod. The same reaction is displayed by lactucerin, to which in its general characters euphorbon is closely allied. If a few drops of an alcoholic solution of euphorbon are allowed to dry on a piece of filtering paper, and then touched with a drop of nitric acid, a blue colour will be developed.

Pure euphorbon, according to Henke, melts at 67° to 68°; its composition was found to be $C^{20}H^{36}O$. Its rotatory power dissolved in chloroform was $[a]_D = +15{\cdot}°88$. Hesse assigns to euphorbon the formula $C^{15}H^{24}O$.

The mucilage of euphorbium is precipitated by neutral acetate of lead, as well as silicate or borate of sodium, it therefore does not agree with gum arabic.

If an aqueous extract of euphorbium is mixed with spirit of wine, and the liquid evaporated, the residual matter assumes a somewhat crystalline appearance, and exhibits the reactions of *Malic Acid.* Subjected to dry distillation, white scales and acicular crystals of *Maleic* and *Fumaric acids*, produced by the decomposition of the malic acid, are sublimed into the neck of the retort. (*Pharmacographia*, 2nd Ed., p. 560.)

Toxicology.—Euphorbium causes the eyes to weep and grow red, the nose to run with watery and even bloody mucus, and saliva to flow abundantly from the mouth. To prevent these effects, says Pereira, some drug-grinders employ masks with glass-eyes, others apply a wet sponge to the nose and face, while others cover the face with crape. Individuals who have been exposed for some time to the influence of this dust suffer with headache, giddiness, and ultimately become delirious. I was informed, he adds, of an Irish labourer who was made temporarily insane by it, and who, during the fit, insisted on saying his prayers at the tail of the mill-horse. In a case which fell under his notice a man

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grew suddenly delirious, and presently became insensible and fell in a fit. His face was red and swollen, his pulse frequent and full, and his skin very hot. On being bled, his consciousness returned and he complained of great headache.

Under Euphorbiaceæ, Norman Chevers, quoting Dr. H. Cleghorn of Madras, says:—"There are several species of Euphorbia, as the *E. neriifolia, antiquorum, acaulis,* and others which abound in a milky juice. This produces a blister when rubbed on the integuments, and serious inflammation if dropped into the eye. Several cases have happened within my knowledge, where the sight has been endangered from this cause." (*Indian Med. Jurisprudence.*)

Other species of Euphorbia found in India, and occasionally used medicinally, are **E. helioscopia,** *Linn.*, the Sun Spurge, a native of Afghanistan and the Punjab, **E. hypericifolia,** *Linn.*, and **E. Royleana,** *Boiss.*, a native of the outer Himalaya.

E. helioscopia is used as a hydragogue cathartic, and the juice is applied to remove warts. Dr. Baudry (*Bull. Med. du Nord,* 1887) has reported a case of severe ulceration resulting from the application of a poultice of the bruised plant.

E. hypericifolia has not unfrequently been mistaken for *E. pilulifera,* but may be distinguished readily by its not having the hairy stem of the latter plant. In Réunion it is used as an astringent in dysentery under the name of *Herbe Jean-Robert.*

PHYLLANTHUS EMBLICA, *Linn.*

Fig.—*Brand. For. Fl., t.* 52; *Bedd. Fl. Sylv., t.* 258; *A. Juss. Tent. Euphorb., t.* 5, *f.* 15; *Rheede, Hort. Mal. i., t.* 38. Emblic myrobalan (*Eng.*), Emblic officinal (*Fr.*).

Hab.—Throughout tropical India. The fruit, bark, and flowers.

Vernacular.—Ánvula (*Hind.*), Ámlaki (*Beng.*), Ávala, Avalkáthi (*Mar.*), Nelli-kai, Toppi (*Tam.*), Nelli-kaya, Usirike-kaya (*Tel.*), Nelli-kaya (*Mal.*), Nelli-kayi (*Can.*), Ambala (*Guz.*).

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History, Uses, &c.—The fruit of this tree is the Dhátriphala, Amritaphala, Ámalaka or Sriphala of the Nighantas, and is described as having all the properties of the chebulic myrobalan. It is used both fresh and dried; in the former condition it is considered to be refrigerant, diuretic and laxative; in the latter, astringent. It is pickled by the natives, and, on account of a peculiar flavour which it imparts, some of the forest tribes eat it before drinking water. A sherbet of the fruit, sweetened with sugar or honey, is a favourite cooling drink for sick people; it is said to be diuretic. A country-side prescription for biliousness in the Concan is *Avala*, 4 massas, to be soaked all night in water, and in the morning to be pounded and mixed with a quarter seer of milk and flavoured with sugar and cumin. Emblic myrobalans are an ingredient in many compound preparations described in Sanskrit works. A selection of these prescriptions will be found in Dutt's *Hindu Materia Medica;* the following, translated from Chakradatta, may be taken as an example:—

"*Dhátri lauha.*—Take of powdered Emblic myrobalans 64 tolás, prepared iron 32 tolás, liquorice powder 16 tolás, mix them together, and soak in the juice of *Tinospora cordifolia* seven times successively. This preparation is given in jaundice, anæmia and dyspepsia, in doses of from 20 to 40 grains."

Mahometan physicians esteem this myrobalan equally with the Hindus; they describe it as astringent, refrigerant, cardiacal, and a purifier of the humors of the body. It is much prescribed by them in fluxes, and is also applied externally on account of its cooling and astringent properties The Arabic name is Amlaj, and the Persian Ámala. Ainslie states that the flowers, which have an odour resembling that of lemon peel, are supposed by the Vytians to have virtues of a cooling and aperient nature, and are prescribed in conjunction with other articles in the form of an electuary. (*Mat. Ind.*, ii., p. 244.) In the *Pharmacopœia of India* it is stated, upon the authority of Dr. Æ. Ross, that the root by decoction and evaporation yields an astringent extract equal to catechu, both for medicinal

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purposes and in the arts; the chips of the wood or small branches thrown into impure or muddy water, according to the same authority, clear it effectually. In the Concan the juice of the fresh bark, with honey and turmeric, is given in gonorrhœa.

Description.—Fresh Emblic myrobalans are globular, fleshy, smooth, six-striated, of a yellowish-green colour, and sometimes as large as a walnut; they contain an obovate obtusely triangular, 3-celled nut, each cell of which contains two triangular seeds. The taste of the pulp is acid, astringent, and somewhat acrid. The dried fruit is the size of a cob nut, subhexagonal, wrinkled, of a grey-black colour if it has been collected when immature, but yellowish-brown if mature; the latter upon pressure breaks up into six parts, each of which consists of a section of the pulp and nut, and contains one triangular brown seed.

Chemical composition.—The pulpy portion of the fruit dried at 100°C., and freed from the nuts, had the following composition:—

Ether extract (gallic acid, &c.)	11·32
Alcoholic ,, (tannin, sugar, &c.)	36·10
Aqueous ,, (gum, &c.)	13·75
Soda ,, (albumen, &c.)	13·08
Crude cellulose	17·80
Mineral matter	4·12
Moisture and loss	3·83
	100·00

The acidity of the fruit was found to be equal to 9·6 per cent., calculated as acetic acid. The amount of tannic acid, estimated with acetete of lead solution, was 35 per cent., and 10 per cent. of glucose was estimated by means of Fehling's solution on an infusion of the pulp after the removal of the tannin.

Löwe considers this tannin to be identical with the ellagotannic acid of Divi-divi.

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Commerce.—Two kinds of Avala are found in commerce, one entire, and the other cut up, and the nut removed. The fruit is collected in many parts of India. Value, about Rs. 32 per candy of 7 cwts.

PHYLLANTHUS RETICULATUS, *Poir.*

Fig.—*A. Juss. Tent. Euphorb.* 19, *t.* 4, *f.* 1; *Wight Ic.*, *t.* 1899; *Burm. Thes. Zeyl.*, *t.* 88.

Hab.—Throughout tropical India. The leaves and bark.

Vernacular.—Pánjoli (*Hind.*), Púlagúda (*Tel.*), Púlavayr (*Tam.*), Pánkúshi (*Beng.*), Pavaṇa, Puvana (*Mar.*), Kamohi (*Sind.*), Datwan (*Guz.*), Katu-nirúri (*Mal.*).

History, Uses, &c.—Ainslie (*Mat. Ind.*, ii., 223) gives Krishna-kámboji as the Sanskrit name of this plant. Kámboja, "coming from Kámboj," is applied in that language to several plants, but none of them have been identified with *P. reticulatus*, nor does it appear to be mentioned in the Nighantas under any other name. The leaves and bark are used as a diuretic and cooling medicine and as an alterative. Ainslie says:—"This bark, as it appears in the Indian bazars, is commonly in pieces about a foot long, and as thick as the wrist, of a dark colour outside, and of a faint sweetish taste; it is considered as alterative and attenuant, and is prescribed in decoction, in the quantity of 4 ounces or more twice daily." In the Concan the juice of the leaves is made into a pill with camphor and cubebs, and dissolved in the mouth as a remedy for bleeding from the gums; it is also, along with the juice of other alterative plants, reduced to a thin extract, and made into a pill with aromatics. This pill is given twice a day, rubbed down in milk, as an alterative in heat of blood.

Description.—Shrubby, climbing, primary branches twiggy; young shoots pubescent; floriferous branchlets angular; leaves oval-obtuse, bifarious; flowers axillary, aggregated, several males and usually one female; male flowers purplish; berries size of a pea, dark-purple. This plant is common near water, and extends to Sind, where it is found in the forests of

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great size, climbing to the tops of the highest trees. (*Bomb. Flora.*) The flowers have a peculiar and disagreeable smell. The bark is dark-brown externally, and thickly studded with little elliptic warty rings; beneath the suber is a deposit of chlorophyll, but the substance of the bark is of a dull-red colour. Taste sweet and astringent. Microscopically there is little to remark beyond masses of deep purple pigmentary matter and groups of large stone cells.

Chemical composition.—The leaves contained a tannic acid similar to that separated from other species of this genus, but no alkaloid. A crystalline principle soluble in ether was removed from the aqueous solution of the alcoholic extract; it gave a yellowish-brown colour with sulphuric acid, a brown colour with Fröhde's reagent, and a yellow solution with alkalies. The powdered air-dried leaves afforded 7·83 per cent. of ash, and when mixed with water became very mucilaginous, and it was very difficult to filter this mixture through paper.

Phyllanthus madraspatensis, *Linn., Wight Ic.,* 1895, *f.* 3, yields the Kanocha seed of the bazars. The seeds are polished, triangular, of a grey colour, prettily marked with delicate dark-brown lines like basket-work; length $\frac{1}{10}$ of an inch; breadth somewhat less; one side is arched, the other presents two sloping surfaces united to form a longitudinal ridge, at the pointed end is a small scar marking the attachment to the ovary; the testa is hard and brittle. When soaked in water they immediately become thickly coated with a semi-opaque mucilage; the kernel is oily and has a sweet nutty taste; the seeds are used medicinally on account of the mucilage which they afford.

PHYLLANTHUS NIRURI, *Linn.*

Fig.—*Wight Ic., t.* 1894; *Rheede, Hort. Mal. x., t.* 15.

PHYLLANTHUS URINARIA, *Linn.*

Fig.—*Wight Ic., t.* 1895, *f.* 4; *Rheede, Hort. Mal. x., t.* 16.

Hab.—Throughout India. The herbs.

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Vernacular.—Bhumi-a'nvala (*Hind.*), Bhui-amla (*Beng.*), Bhui-a'vala (*Mar.*), Kizhkay-nelli (*Tam.*), Nelli-usirika (*Tel.*), Kizha-nelli (*Mal.*), Kiranelli-gida (*Can.*), Bhui-amali (*Guz.*). *P. urinaria* is distinguished by the addition of the adjective red to the above names.

History, Uses, &c.—These plants are common weeds which appear in the cold season. They are called in Sanskrit Támra-valli (*P. urinaria*) and Bhumy-ámali (*P. Niruri*), and bear among other synonyms those of Tamalika, Bhu-dhátri, and Bahu-pattra, "having many leaves." Hindu physicians consider them to be deobstruent, diuretic, astringent and cooling, and prescribe the dried plant in powder or decoction in jaundice. The dose of the powder is about a teaspoonful. Mir Muhammad Husain in the *Makhzan* states that the milky juice is a good application to offensive sores, and that a poultice of the leaves with salt cures scabby affections of the skin; without salt it may be applied to bruises, &c. From Ainslie we learn that these two plants are the *Herba mœroris alba* and *rubra* of Rumphius, and that an infusion of the leaves of *P. Niruri* with fenugreek seed is considered a valuable remedy in chronic dysentery, also that the leaves are a good stomachic bitter. In Bombay *P. Niruri* is used as a diuretic in gonorrhœa and acidity of the urine. The dose is 2 tolás of the juice with 2 tolás of ghí twice a-day. The root rubbed down with rice-water is given in the Concan as a remedy for menorrhagia.

Dr. A. J. Amadeo states that the plant is known as *Yerba de quininic* at Porto-Rico, and is used in decoction in intermittent fevers; he thinks favourably of it, and uses a tincture in 2-drachm doses; it acts as a gentle purgative, and is especially useful when the liver and spleen are infarcted. It is diuretic.

Description.—*P. Niruri:* Annual, erect-branched; branches herbaceous, ascending; floriferous branchlets filiform; leaves elliptic, mucrônate, entire, glabrous; male and female flowers in separate axils, male on the lower ones; dehiscence of anthers transverse; glands in the female bifid

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and trifid; capsule globose; two smooth seeds in each cell; seeds triangular.

P. urinaria: Root generally annual, though in some soils biennial and even perennial. Stem erect, striated, of a pale reddish colour; branches several, ascending, striated from the insertions of the stipules; leaves scattered, spreading, pinnate, from one to two inches long, flower-bearing; leaflets alternate, linear oblong, entire, smooth, $\frac{3}{4}$ of an inch long, and $\frac{1}{4}$ broad; petioles compressed, somewhat triangular; stipules of the petioles 3-fold, acute, membranaceous, those of the leaflets two, lateral; male flowers, exterior leaflets axillary, 2 to 3, subsessile; calyx, nectary and stamens as in *P. Niruri*; female flowers, lower leaflet axillary, solitary, sessile; calyx and nectary as in the male; capsules scabrous, 3-celled, 6-valved; seeds, two in each cell, transversely striated on the outside. It is immediately distinguished from *P. Niruri* by its sessile flowers and scabrous capsules. (*Roxb.*)

Chemical composition.—The alcoholic extract from the whole plant was mixed with water acidulated with sulphuric acid, and agitated first with petroleum ether, then with ether, and finally rendered alkaline and reagitated with ether.

The petroleum ether extract was dark-coloured, and soft, with a tea-like odour, and extremely and persistently bitter. It was mixed with 3 per cent. caustic soda solution and reagitated with petroleum ether, which removed the bitter principle contaminated with traces of oil and colouring matter. This extract gave the euphorbon colour reaction when treated with sulphuric and nitric acids. For the bitter neutral principle, we propose the name of *pseudochiratin*.

The acid ether extract contained green colouring matter, and was partly soluble in water with acid reaction, the solution giving a dirty bluish-green coloration with ferric chloride, slightly precipitating gelatine, but affording no reaction with cyanide of potassium.

The alkaline ether extract contained an alkaloidal principle, which, after purification, was obtained in white feathery crystals

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without any special taste. With Fröhde's reagent it gave a light yellowish-red coloration, changing to blue on heating; with concentrated nitric acid, yellowish. No reaction with dichromate of potassium and sulphuric acid.

BRIDELIA RETUSA, *Spreng.*

Fig.—*Baill. Etudes Gen. Euphorb.*, *t.* 25, *f.* 25—34; *Bedd. Fl. Sylv.*, *t.* 260; *Rheede, Hort. Mal. ii.*, *t.* 16.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Khája, Kharaka, Lamkana (*Hind.*), Mulluvengai (*Tam.*), Dudhi-maddi, Kora-maddi (*Tel.*), A'sána, Phattar-phoda, Páléhasan, Kántehasan, Hasáni (*Mar.*), A'sána, Gurige (*Can.*).

History, Uses, &c.—The astringent properties of the bark of this tree appear to be well known throughout India, as it is in general use for tanning leather. The wood is also much used, on account of its durability under water, for making well-curbs. In Western India the bark has a reputation as a lithontriptic, and is in general use as an astringent medicine. The tree is with or without thorns, according to situation and soil; the natives of Western India consider the thornless tree to be a distinct species, and call it Pálehasan, whilst the thorn-bearing tree is known to them as Kántehasan. When wounded, the bark exudes a blood-red juice, which stains the hands, and is very astringent.

Description.—The dry bark is externally of a light-brown colour, and has little fungous protuberances of dead suber; internally it is smooth and fibrous, of a cinnamon colour; taste purely astringent. If soaked in water it gives out much mucilage. The fibrous portion of the bark is very tough and strong. Sections placed under the microscope show the outer portion to be made up of thin-celled reddish parenchyma; in the inner portion there is much woody fibre and numerous vessels, the external surface of which is encrusted with large crystals arranged in regular columns

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Chemical composition.—The bark afforded 41·7 per cent. of water extract, containing 39·9 parts of tannic acid. The tannic acid gave a greyish-green precipitate with plumbic acetate, and a blue-black colour with ferric chloride. The air-dried bark left 7·35 per cent. of ash on incineration. Although this is one of the most astringent barks in India, it does not appear to be known to, or used by, Europeans in the arts.

CLEISTANTHUS COLLINUS, *Benth.*

Fig.—*Beddome, Foresters' Man.*, 203, *t.* 23, *f.* 5; *Roxb. Cor. Pl. ii.*, 37, *t.* 169. *Syns.: Lebidieropsis orbicularis*, Müll-Arg., *Cluytia collina*, Roxb.

Hab.—Dry hills, in various parts of India, from Simla to Behar. Deccan Peninsula.

Vernacular.—Oduvan, Woodacha, Nachuta (*Tam.*), Kadishe (*Tel.*)., Kodasigina, Bodadaraga (*Can.*).

History, Uses, &c.—Under the name of *Andrachne Cadishaw,* Ainslie describes the poisonous properties of the nut of this tree, called *Wodoowunghai.* He says:—"About one pagoda weight, pounded, the Tamools believe to be sufficient to kill a man; the leaves and roots of the plant are also considered poisonous; the first, which no animal will touch, is, in conjunction with *Kadukai* (chebulic myrobalans), supposed to be a good application to foul ulcers. (*Mat. Ind.*, ii., 487.) Roxburgh remarks:—"The bark or outer crust of the capsule is reported to be exceedingly poisonous." (*Fl. Ind.*, iii., 733.)

Description.—Capsule $\frac{3}{8}$ of an inch in diameter, sessile, woody, rounded-3-gonous, top not lobed, dark-brown, shining and wrinkled when dry. Seeds $\frac{1}{6}$ of an inch in diameter, globose, chestnut-brown; albumen scanty.

Chemical composition.—The active principle of the plant does not appear to be an alkaloid, but, though its chemical nature has not yet been fully investigated, Mr. Newman, Assist. Chemical Examiner, Madras, has discovered that it gives a purple reaction with sulphuric acid, which disappears on oxidising with

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alkaline dichromate, and with nitric acid a blue colour changing to green; these tests serve to identify it with some degree of probability. An extract of the leaves and fruit acts as a violent gastro-intestinal irritant. (*Report, Madras Chem. Examiner*, 1885.)

Toxicology.—The Madras Chemical Examiner reported in 1885 that the poison had been found in two cases from South Arcot. "In one case a man being detected in an intrigue with his mother-in-law, her relations threatened to excommunicate her; whereupon both are supposed to have taken this poison and to have died very soon—from half an hour to an hour—after taking it. Both vomited. In the second case vomiting and purging were followed by recovery." In 1886 the same Chemical Examiner reported that the expressed juice of certain leaves (of *Oduvan*), the residue of which was sent for examination mixed with common salt, was supposed to have been taken by a man to cure itch. He suffered from vomiting and died in a few hours. In 1887 *Oduvan* was found, in a case from South Canara, in the stomach of a woman who poisoned herself when her husband was dying. She was suddenly seized with vomiting and died rapidly. In 1889 a woman was suspected of attempting suicide by poison; the leaves found in her possession were identified as those of this plant. In 1890 a pregnant woman died with symptoms of gastro-intestinal irritation, after taking an abortifacient; from her stomach was extracted a non-alkaloidal poison which gave reactions similar to those obtained from the extract of this plant.

The bark of **Flueggia Leucopyrus**, *Willd., Wight Ic., t.* 1875, a shrub of the Punjab Plain, the Deccan Peninsula, and Ceylon, is used both in Madras and Bombay as a fish-poison. The sweet, white berries do not appear to have any injurious properties, as they are eaten by children, who call them *Madh* (honey). The juice of the leaves is used to destroy worms in sores.

Chemical composition.—The bark contains 10 per cent. of a tannic acid, giving a violet-black colour with ferric chloride,

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and the mixture becomes red on the addition of ammonia. An alkaloid is also present, giving a purplish-red colour, afterwards turning to green, with Fröhde's reagent, and a violet colour with strong sulphuric acid and permanganate of potassium. The alkaloid is soluble in excess of alkalies. The infusion was somewhat frothy, but no sapogenin could be isolated from it after boiling with acid.

The bark of **Flueggia microcarpa**, *Blume, Wight Ic., t.* 1994, supplied by Mr. Hollingsworth as one of the South Indian fish-poisons, was in thin papery light-brown strips, and the powder had no odour and very little taste. Air-dried, it afforded 11·4 per cent. of mineral matter, and contained 8·9 per cent. of a tannin, giving a blue-black colour with ferric salts. The aqueous solution of the alcoholic extract furnished an alkaloidal principle similar in its reactions to that obtained from the bark of *F. Leucopyrus*.

Breynia rhamnoides, *Müll-Arg., Wight. Ic., t.* 1898, is a shrub or small tree of tropical India. According to Ainslie, it was brought to Dr. F. Hamilton, while in Behar, as a medicine of some note; the dried leaves are smoked like tobacco, in cases in which the uvula and tonsils are swelled. The bark is astringent.

Description.—Shrubby; young shoots angular; leaves alternate, short-petioled, spreading, broad-oval; exterior ones largest, below whitish, entire, half to three-quarters of an inch long; male flowers racemed from the lower axils; female flowers in the upper axils, solitary, short-peduncled, drooping; capsule size of a pea.

The nuts of **Putranjiva Roxburghii**, *Wall.*, in Sanskrit Putra-jiva or Putram-jiva, "that which makes the child live," are hung round the necks of children to keep them in good health. They are mentioned in the Nighantas as being also Garbha-kara, "productive of impregnation," and medicinal properties are attributed to them. The hard wrinkled nuts are generally worn only as a charm, but are sometimes given internally in colds on account of their supposed heating properties;

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they are called Jivapota in Hindi, Kurupale in Tamil, Kabrajuvi in Telugu, Pongalam in Maliyali, and Jivanputra in Marathi.

JATROPHA GLANDULIFERA, *Roxb.*

Hab.—Deccan Peninsula, Bengal, Northern Circars, and sparingly elsewhere. The juice, root, and oil.

Vernacular.—Underbibi, Rán-erandi, Tadki-erandi (*Mar.*), Lál-bherenda (*Hind., Beng.*), U'dalai (*Tam.*), Nela-amudamu (*Tel.*).

History, Uses, &c.—This plant appears to have been introduced into India, but it is not known from whence. Graham, in his *Catalogue of Bombay Plants*, published in 1839, says that in his time it was only to be found at Punderpore in the Deccan (a place much frequented by pilgrims, who come to visit the temple of Vithoba). There is a fabulous legend that it suddenly made its appearance at this place. The following is the story, for which we are indebted to Dr. Shantaram V. Kuntak of Punderpore :—" A certain cultivator was sowing his field on the 10th day of Áshádh, during the Áshádhi fair ; whilst thus engaged he was accosted by numbers of pilgrims who were passing by his field, on their way out of the town, to meet the palanquins of Dnyánoba, Námdeo and Tukáram, which are brought to Punderpore at this season from Paithan, Alandi, and Dehu. All the pilgrims asked him what he was sowing, until the man got tired of answering their questions ; in a short time another pilgrim came up and asked the same question,—the man, vexed beyond endurance, answered that he was sowing चोट (membrum virile). It is said that this last pilgrim was the god Vithoba in disguise, who was going to meet the palanquins of his devotees, and that, annoyed at the cultivator's answer, he cursed him, saying, 'As you sow, so may you reap.' So when harvest time came, instead of the usual crop, the whole field was covered with this short thick-stemmed plant." Until within

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the last few years the field was called after the strange crop which it bore. It is now cultivated by a Mahometan, and produces a regular crop, but the Jatropha has not been entirely extirpated. Since Graham's time the plant has spread rapidly, and may be seen on waste ground in most parts of the island of Bombay, probably introduced along with the Castor seed of commerce. An oil is prepared from the seeds by roasting them in a perforated earthen vessel, fitted upon another vessel, into which, when the whole apparatus is heated in a pit filled with burning cowdung fuel, the oil drops. This oil is valued as an application to chronic ulcerations, sinuses, ringworm, &c. The root brayed with water is given to children suffering from abdominal enlargement; it purges, and is said to reduce glandular swellings. The juice of the plant is used in various parts of India as an escharotic to remove films from the eyes; it is greenish and viscid. The expressed oil of the seeds is yellow, has a specific gravity of 0·963, and solidifies at 5° C. (*J. Lepine, Jour. Phar.* [3], xl., 16.)

Description.—A small shrub, remarkable for the shining reddish-brown colour of its young foliage. The leaves are palmate, 3 to 5-cleft, panicles terminal, short, few-flowered; flowers small and red. The young branches and petioles of the leaves are thickly studded with sticky red glandular hairs. The capsules are 3-celled and 3-seeded, with an outer adherent fleshy epicarp, which dries up as the fruit ripens; when this takes place, the three triangular woody cells of which it is composed divide into six pieces suddenly with a sharp report, and the seeds are projected to a considerable distance; it is, therefore, necessary to gather the fruit before it is quite ripe and dry in a covered place. The seeds, including the strophiole, are three-tenths of an inch long and two-tenths broad; they are of a grey colour with two brown stripes on the dorsum, which is convex, the underside has two flat surfaces, divided by a central ridge. The kernel is without smell, and very oily; it has a sweet, nutty taste.

Chemical composition.—See *Jatropha Curcas.*

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Jatropha nana, *Dalzell*, Kirkundi (*Mar.*), is a rare plant, found in waste, stony places near Poona. The juice is employed as a counter-irritant in the same manner as that of *J. glandulifera.*

Description.—A shrub 1 to 1½ foot high, all smooth; root tuberous, woody; root-bark thick and full of milky juice; stem round, smooth, very little branched; branches erect; leaves large for the size of the plant, sessile or shortly petioled, broadly ovate, entire or trilobate; lobes obtuse, central much the largest, 4 to 6 inches long and broad, pale beneath, 3-nerved, flowers panicled, terminal, few, 3 to 5 on each division; stipules minute; flower solitary, pedicelled, subtended by a subulate bract half its length; calyx leaves six, small, subulate; fruit obovoid, flattened at the top, slightly six-sulcated, as large as a nut. (*Dalzell.*)

JATROPHA CURCAS, *Linn.*

Fig.—*Jacq. Hort. Vind. iii., t.* 63; *A. Juss. Tent. Euphorb., t.* 11, p. 34 A. Physic Nut (*Eng.*), Medicinier (*Fr.*).

Hab.—Throughout India and Ceylon, naturalized.

Vernacular.—Bághrénda, Bágh-bherenda (*Hind., Beng.*), Moghli-erandi, Jepál (*Mar.*), Galamark (*Goa*), Káttámanakku (*Tam.*), Pépálam (*Tel.*), Káttá-vanakka (*Mal.*), Bettada-haralu (*Can.*), Jangli-arandi (*Guz.*).

History, Uses, &c.—This tree, introduced from America, is called by recent Sanskrit writers Kánana-eranda. Its seeds are sometimes used as a purgative and alterative by the Hindu physicians, but on account of their uncertain action they are not much esteemed. The oil is reckoned a valuable external application to itch, herpes, chronic rheumatism, and sores or wounds. Descourtilz states that the blacks of Rio Nunez saponify the oil with the ashes of the Papaya, and use the preparation to heal the wounds caused by circumcision.

The leaves are applied as a rubefacient and discutient, and a decoction of them is said to excite the secretion of milk in

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women. The viscid juice which flows from the stem upon incision is painted over cuts and wounds to check bleeding and promote healing; this it does by forming a thin film when dry like that produced by collodion. The author of the *Makhzan* also notices this use of the juice, and calls the plant *Bághréndeh.* Mr. Udoy Chund Dutt notices the hæmostatic properties of the juice, and Dr. Evers has injected a drachm of it into a varicose aneurism. He says:— "The result was astonishing; in twenty minutes time the pulsation was so faint that no non-professional person could have detected it; and by evening all pulsation had ceased, and a good firm clot had been produced. No ill-effects resulted from the injection." *J. Curcas* is said to have been introduced from Brazil by the Portuguese; it is now quite naturalized in many parts of India, and is a common hedge-plant in the Concans. The oil is used for burning. The juice, when dried in the sun, forms a bright reddish-brown, brittle substance like shell-lac, which may yet be put to some useful technical purpose. In Goa the root-bark is applied externally in rheumatism. In the Concan it is rubbed with a little asafœtida and given with buttermilk in dyspepsia and diarrhœa. The fresh stems are used as a tooth brush to stop bleeding from the gums. Roxburgh notices that the leaves warmed and rubbed with Castor oil are used by the natives as a suppurative.

Jatropha oil was formerly employed as a purgative by European physicians, under the names of *Oleum Ricini majoris* and *Oleum infernale.* At the present time it is much used for burning and for soap-making; also for adulterating olive oil, and seemingly for making Turkey-red oil. (*F. M. Horn, Zeit. Anal. Chem.*, xxvii., 163—165.

Description.—The young roots are soft, fleshy, and tapering, with a whity-brown scaly epidermis, and a few thin rootlets, bark yellowish-white internally, with a peculiar perfume like tuberose when freshly removed; wood white and very soft. On section the bark is seen to contain oil globules and very numerous conglomerate raphides; the vascular system is full of a

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yellowish viscid secretion; the wood is loaded with starch. The taste of the bark is acrid.

The fruit is ovoid, 6-striated, tricoccous and fleshy; when ripe it is of a pale greenish-yellow; as it gradually dries up it becomes black and partially dehiscent. There is one seed in each cell. The seeds (*Pignons d'Inde*) are of the same shape as Castor seeds, ¾ of an inch long and rather less than half an inch broad; the dorsal surface is arched and marked by a hardly perceptible ridge about the middle; the ventral surface has a well-marked ridge. At one end of the seed is a white scar. The testa is of a dull black and irregularly fissured all over, the fissures are yellowish. The kernel is enclosed in a thin, white membranous covering like that of the Castor seed.

The cotyledons are foliaceous, the radicle short and thick, the albumen copious and oily.

Chemical composition.—The kernels of the seeds of *J. Curcas* were found by Arnaudon and Ubaldini (*Kopp's Jahresber.*, 1858) to contain 7·2 per cent. water, 37·5 oil, 55·3 sugar, starch, albumin, casein, and inorganic matters. The kernels yielded 4·8 per cent. ash, and 4·2 per cent. nitrogen; the kernels and husks together 6 per cent. ash, and 2·9 per cent. nitrogen. The oil yielded by saponification, glycerine and an acid, which, as well as the unsaponified oil, produced caprylic alcohol by distillation with hydrate of potassium. Bouis had previously separated from it a liquid and solid fatty acid, and named the latter *Isoacetic Acid*, $C^{15}H^{30}O^{2}$. Cadet de Gassicourt (1824) found in the seeds an acrid resin.

F. M. Horn (*Zeit. Anal. Chem.*, xxvii., 163—165) states that the oil begins to crystallize at 9°, and is completely solid at 0°, at 15° its sp. gr. is 0 9192. It differs from Castor oil in its very sparing solubility in alcohol. It appears to saponify readily in the cold, but in reality forms only acid soaps; for complete saponification heat is required, and solid potash acts better than solution.

The fluid oleic acid obtained by Bouis may doubtless be regarded as ricinoleic acid.

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According to Dr. H. Stillmark, the seeds contain *Ricin*, the poisonous principle of Castor seeds (see *Ricinus*).

Toxicology.—Christison (*Poisons*, p. 591) found from 12 to 15 drops to have generally the same effect as an ounce of Castor oil. Stillé and Maisch remark that it is more like Croton oil in its action. The acrid emetic principle resides chiefly in the embryo. It is stated that if the embryo is wholly removed, four or five of the seeds may be used as a purgative without producing either vomiting or griping. This opinion is supported by experiments upon dogs. A number of cases have occurred of poisoning by eating the seeds entire. In one case, a man who had eaten five of them soon complained of burning in the mouth and throat, and the whole abdomen felt distended and sore. In a few minutes vomiting occurred, and was repeated five times in the course of an hour, accompanied with active purging. The pain continued; the patient complained of feeling hot and giddy; he then became delirious, and afterwards insensible. On regaining consciousness several hours later his face was pale, his hands cool, the pulse 110 and weak. He recovered.

Several cases of accidental poisoning by the seeds have been recorded in India, and Chevers mentions one in which, in addition to the usual symptoms, muscular twitchings, deafness, impairment of sight, and loss of memory were observed.

Jatropha multifida, *Linn., Salisb. Hort. Paradis., t.* 91, the Medicinier d'Espagne of the French, and Coral tree of the English, is a common ornamental shrub in Indian gardens; it is not used medicinally, and only requires a brief notice on account of its seeds, which are powerfully purgative and emetic, sometimes giving rise to accidents when eaten by children. The plant is easily recognised by its multifid leaves and beautiful, red coral-like panicles of flowers. The fruit is bright-yellow when ripe, as large as a walnut, six-angled and three-celled, each cell contains a scabrous black seed resembling that of *J. Curcas*. We have found limejuice and stimulants to be the best remedies in cases of poisoning by the seeds. The

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plant appears to have been introduced by the Portuguese from Brazil, where the oil of the seeds is known as *Pinhoen oil*, and is used as an emetic.

At Martinique it is called *Ipeca pays*, on account of its being used in a similar manner; one seed acts as an emeto-cathartic. Corre and Lejanne state that the Creole women used to prepare an "*Orange purgative*" by macerating an orange in the oil for a month, and then drying it; this orange, when rubbed in the hands and smelt, was believed to act as a purgative.

According to Soubeiran, the oil of these seeds is very similar to, if not identical with, that of *J. Curcas.*

Toxicology.—Cases of accidental poisoning by the fruits have been recorded in India, chiefly among children who have been attracted by their tempting colour. The symptoms have been similar to those produced by *J. Curcas.*

ALEURITES MOLUCCANA, *Willd.*

Fig.—*Lamk. Ill., t.* 791; *A. Juss. Tent. Euphorb., t.* 12; *Rumph. Amb. ii., t.* 58. Candleberry tree (*Eng.*), Aleurit des Molluques (*Fr.*).

Hab.—Pacific Islands. Cultivated in India. The oil.

Vernacular.—Jangli-akhrot (*Hind.*), Rán-akhrot, Japhala (*Mar.*), Jangli-akhroda (*Guz.*), Náttu-akhrotu (*Tam., Tel.*), Nát-akrodu (*Can.*).

History, Uses, &c.—Rumphius (iii., 12) states that the Javanese and Macassars make candles of the seeds of this tree, either pounded and mixed with cocoanut or cotton seeds, or simply strung upon a piece of split bamboo; they also eat the seeds raw and roasted. In the South of India, where the tree is much cultivated, the seeds are known as Indian walnuts. When pressed they yield a large proportion of oil, used as a drying oil for paint, and known as country walnut oil, bankoul-nut oil and artist's oil. In Ceylon it is called *Kekuni oil*, and in the Sandwich Islands, where it is used as a mordant for their vegetable dyes, *Kakui oil.* In these islands alone

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about 10,000 gallons are annually produced. It has been imported into Europe for soap-making, but not to any considerable extent, and fetches about £20 per imperial ton. The oil is stated to possess powerful desiccative properties. The cake, after the oil has been expressed, is esteemed as a manure. The root of the tree affords a brown dye, which is used by the Sandwich Islanders for their native cloths. In India the oil is used as a dressing for ulcers; its medicinal properties were examined by Dr. O. Rorke (*Ann. de Thérap.*, 1859, p. 117), who found that in doses varying from 1 to 2 ounces it acted as a mild and sure purgative, producing in from three to six hours, after ingestion, free bilious evacuations, its operation being unattended either by nausea, colic or other ill-effects. (*Phar. of India*, p. 203.) From more recent experiments it appears that half an ounce of the oil is a sufficient aperient. MM. Corre and Lejanne (*Résumé de le Mat. Med. et Tox. Coloniale*) remark:—"There is no doubt that the properties of this oil differ when the oil is prepared in different ways." When cold drawn from the fresh nuts, Heckel, who used it at the Military Hospital at Nouméa, found that it was only purgative in 80 gram doses, that is to say, it simply acted as a fatty oil; he found that the drastic resinous constituents remained in the oil-cake. M. Jugant, at Nosi-Bé, found that the oil extracted by the hot process acted freely as a purgative in 40 gram doses. Many observations were made in the Military Hospital with the result that the oil was found to operate in from 1 to 3½ hours. Dr. Grasourdy considers the oil to equal castor oil in purgative properties. The oil, if intended to be used as a purgative, should be extracted by pressure between hot plates.

Description.—A tree of considerable magnitude, attaining the height of 30 to 40 feet. The leaves are alternate, four to eight inches long, stalked and without stipules, either oval-acute and entire, or from three to five-lobed, and like all the young parts covered with a whitish starry pubescence. The flowers are small and white, growing in clusters at the apex of the branches, the males and females together in the

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same cluster, the former being the most numerous. The fruit is 2-celled, fleshy, roundish, and, when ripe, of an olive colour, its greatest diameter about 2½ inches; each cell contains one ovoid somewhat flattened nut, the shell of which is very hard and thick; the kernel is conform to the nut, white and oily.

Chemical composition.—The nuts have been examined by Nallino (*Gaz. Chim. Ital.*, ii., 257), who found the average weight of the husks to be 6·5 grams, of the almonds 3·3 grams. Composition of husks: water, 3·71; organic matter, 89·90; mineral matter, 6·39. Composition of almonds: water, 5·25; fat (extracted by carbon sulphide), 62·97; cellulose and other organic matters, 28·99; mineral matter, 2·79. Composition of the ash of the almond: lime, 18·69; magnesia, 6·01; potash, 11·33; phosphoric anhydride, 29·30. The fatty matter extracted from the almonds by carbon sulphide at ordinary temperatures forms a transparent, amber-yellow, syrupy liquid. When cooled to —10°, it becomes viscous, but neither loses its transparency nor changes colour. According to Brannt, the oil has a specific gravity of 1·940 at 59°F. It consists of an olein resembling linolein, besides myristin, palmatin and stearin. The purgative principle is probably an acrid resin. The oil-cake from Indian and Tahitian seeds has respectively the following percentage composition:—

	Indian.	Tahitian.
Oil	8·93	9·20
Organic matter	74·04	74·24
Ash	8·96	9·36
Water	7·07	7·20

The albuminoids were respectively equal to 52 and 51·7 per cent. (*Brannt.*).

An allied oil (from *Aleurites cordata*) has been examined by Mr. R. H. Davies (*Pharm. Journ.* [3] xv., 636). It is the wood oil of China, and has remarkable drying properties. The specific gravity at 15°·5C. is ·940, and is unaffected by a temperature of —13°C. It required 211 grams of caustic

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potash to convert one thousand grams of oil into potash soap. The fatty acids amounted to 94·1 per cent., melting at 39°, containing some white crystalline plates melting at 67°.

CROTON TIGLIUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 239; *Rheede, Hort. Mal. ii.*, *t.* 33. Purging Croton (*Eng.*), Croton cathartique (*Fr.*).

Hab.—China. Cultivated in India. The seeds and oil.

Vernacular.—Jaypál, Jamálgota (*Hind.*), Jaypál (*Beng.*), Nipálo (*Guz.*), Jamálgota (*Mar.*), Nepála (*Can., Tel.*), Nerválam (*Tam.*), Nirválam (*Mal.*), Kanako (*Burm.*).

History, Uses, &c.—Croton seeds were not known to the ancient Hindu physicians; in recent Sanskrit works they are noticed under the names of Jayapála, Tittiriphala and Kanakaphala, and are described as heavy, mucilaginous and purgative, useful in fever, constipation, enlargements of the abdominal viscera, ascites, anasarca, cough, &c., expelling bile and phlegm. They are directed to be boiled in milk, the outer skin and embryo having been removed, to fit them for internal administration. The following prescription from the Bhavaprakasa may be taken as an example :—

Mahanaracha rasa.—Take Chebulic myrobalans, pulp of *Cassia fistula*, Emblic myrobalans, root of *Baliospermum axillare* (danti), *Picrorhiza Kurrooa* (tikta), milky juice of *Euphorbia neriifolia* (snuhi), root of *Ipomœa Turpethum* (trivrit), and the tubers of *Cyperus rotundus* (mustaka), each one tolá : pound them to a coarse powder, and boil in four seers of water till the latter is reduced to one-eighth. Then take a tolá of husked Croton seeds, tie them in a piece of thin cloth, and boil them in the abovementioned decoction, till the latter is reduced to the consistence of a fluid extract. To this extract add a powder composed of eight parts of purified Croton seeds, three parts of ginger, and two of black pepper, mercury, and sulphur in quantity sufficient to make a pill mass; rub them together for twelve hours, and make into two-grain pills. These are

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given with cold water in tympanitis, colic, ascites, &c., as a drastic purgative. After the operation of this medicine, rice should be given with curdled milk and sugar.

The Indian names for Croton seeds lead us to suppose that they were first introduced into the country through Nepal. Under the name of Dand they were known to the Persians at a very early date, and were doubtless introduced into that country from China by the Caravan route through Central Asia. The Arabs retained the Persian name, but also called them Hab-el-khatái, "Cathay seeds," and Hab-el-salátín, "Sultans' seeds." Ibn Sina describes them under the name of Dand-el-sini, "China Dand," and also mentions an Indian Dand of smaller size (probably Baliospermum seeds). Ainslie states that Croton seeds were known to the Arabs under the name of *Fill*, but this is incorrect, as may be seen by referring to Ibn Sina, who describes Fil as an Indian drug having the properties of the Mandrake. Mahometan physicians describe the seeds as detergent, a purgative of phlegm, black bile, and adust humors; and recommend their use in dropsy, calculus, gout, and other diseases arising from cold humors. On account of its irritant action upon the fauces, the seed, after having been boiled in milk, is to be crushed and enclosed in a raisin for administration. The author of the *Makhzan* remarks that the Hindus give small doses with fresh ginger tea, to children, as a remedy for whooping cough. He also notices its irritant action upon the skin, and its use as an external application to tumours, &c.; should excessive purging occur, he directs limejuice to be administered. The envelopes of the seed and plumule must always be rejected. *Croton Tiglium* was first described by Christoval Acosta in 1578, afterwards by Rheede in 1679, and Rumphius in 1743. In 1812, Drs. White and Marshall brought the use of the seeds as a purgative to the notice of Europeans in India. The former gentleman gives the following directions for their administration, which he received from a learned Parsee Vaidia of Surat:—"After having removed the shells from the seeds, tie the kernels in a small piece of cloth, like a bag; then put this into as much

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cowdung water as will cover the bag, and let it boil; secondly, when boiled, split the kernels in two and take a small leaf from them, which is said to be poisonous; and thirdly, pound the whole into a mass, to which add two parts of Katha (catechu), and divide into pills of two grains each, two of which are sufficient for one dose." The addition of the Katha is said to correct the acrimony of the drug, and to prevent any griping of the bowels.

Ainslie (*Mat. Indica,* Vol. I., p. 105) notices the use of the expressed oil (nervalum unnay) by the Tamils as an external application in rheumatic affections, but it does not appear to have been used for internal administration until the year 1821. (*Confer. London Medical Depository for January* 1822.)

In modern European medicine, croton oil, more or less diluted, is used externally as a counter-irritant, and causes an abundant pustular eruption. This effect is increased by the addition of an alkali to the liniment. Internally it is given in doses of ½ to 1 minim as a purgative, and is particularly valuable in those cases in which the condition of the patient prevents him from swallowing; it may be placed on the back of the tongue. The oil has also been used with success as an anthelmintic. In modern pharmacy its chief consumption is in the preparation of castor oil capsules.

Description.—Croton seeds (*graines de Tilly*) are oblong, about half an inch long, and not quite ⅜ of an inch broad. The dorsal and ventral surfaces are arched, the former more prominently than the latter. The testa is black, but covered for the most part by a thin cinnamon-coloured membrane; it is thin and brittle, and contains an abundant oily albumen enclosed in a delicate white membrane (endopleura). Between the two halves of the albumen are two foliaceous cotyledons, and a short thick radicle. The structure of these parts closely resembles that of the albumen and embryo of *Ricinus communis.*

Chemical composition.—The fats present in croton oil are glycerides of stearic, palmitic, myristic, and lauric acids, and of several volatile acids of the same series, like acetic, butyric, and

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valerianic acid; also the volatile *tiglinic acid*, $C^5H^8O^2$, which was recognized by Geuther and Frölich (1870), but had previously been observed by Schlippe (1858), who considered it to be identical with angelicic acid. However, it melts at 64° C., boils at 198·5° C., and is identical with Frankland and Duppa's methylcrotonic acid. In the fraction boiling above the temperature named, capronic, œnanthylic, or similar acids are probably present. They did not succeed in obtaining from croton oil an acid having the composition of Schlippe's *crotonic acid*, $C^4H^6O^2$. E. Schmitt (1879) corroborated these statements, and found among the volatile acids also formic acid. Schlippe's *crotonol*, $C^{18}H^{28}O^4$, has likewise not been obtained by other chemists; it was stated to be a yellowish viscid mass of a faint odour, and to be the rubefacient principle of croton oil. The drastic rubefacient properties, according to Buchheim (1873), reside in *crotonoleic acid*, which is present in the free state and as glyceride, and which seems to be related to ricinoleic acid, since, like the latter, it yields with nitric acid œnanthic acid, and on the distillation of its sodium salt gives œnanthol. (*Stillé and Maisch.*)

H. Senier (*Pharm. Journ.* [3], XIV., 446, 447) has shown that when alcohol (sp. gr. ·794—·800) is mixed in equal volumes with English pressed croton oil, perfect solution takes place, the mixture being permanent at all ordinary temperatures, and this is equally true when any less quantity of alcohol is used; when, however, the proportion of alcohol to croton oil becomes as seven volumes to six, or any larger proportion of alcohol, then a part of the croton oil separates. This part varies in quantity in the case of different samples of oil. That part of the croton oil which separates when the alcohol is in excess is afterwards insoluble in any proportion of alcohol. But that portion of the oil dissolved by alcohol is, when separated, soluble in all proportions. The author has shown that the part of croton oil soluble in alcohol contains the vesicating principle, while the portion insoluble in alcohol is entirely non-vesicating. He also shows that the purgative properties of croton oil reside entirely in this insoluble,

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non-vesicating part. The author has endeavoured to ascertain to what constituent of the soluble portion of the oil the vesicating properties are due, and has traced these properties to the non-volatile fatty acids, chiefly to those which have the lowest melting points, are least readily saponified by alkalies, and are first liberated when the alkali soap is decomposed by acids. He attributes the purgative action not to the free acids, but to the combination in which they exist in the oil.

These conclusions not appearing satisfactory to Professor Kobert, the investigation was taken up by Herr von Hirschheydt, a pupil in the University of Dorpat. Upon the basis of the results obtained, Professor Kobert now (*Chem. Zeit.*, April 6, 1887, p. 416) attributes the activity of croton oil, both as a vesicant and as a purgative, to crotonoleic acid, not to be confounded with crotonic acid, but an acid discovered by Buchheim in 1873, to which a formula has not yet been assigned. This crotonoleic acid is said to occur in croton oil both in the free state, in which it is freely soluble in alcohol, and in combination as a glyceride. The glyceride does not possess poisonous properties, but the free acid acts as a powerful irritant to the skin and the intestines (purgative). According to Professor Kobert, the crotonolglyceride is attacked and split up like other glycerides by the ferments of the juices of the stomach, and the crotonoleic acid being set free then exercises its purgative influence. A similar result may be obtained by administering crotonoleic acid as a pill enclosed in keratin. Kobert is not of opinion, however, that the solubility of croton oil is dependent upon the proportion of crotonoleic acid it contains, but considers it to be connected with the age of the oil. Crotonoleic acid may be prepared by treating the portion of croton oil soluble in alcohol with a hot saturated solution of baryta in a water-bath, washing the stiff white paste that forms with cold distilled water to remove excess of baryta, and barium compounds with acetic, butyric and tiglinic acid, removing by heat traces of water, and repeatedly treating with ether, which only takes up the barium oleate and crotonoleate. The crotonoleate is separated by dissolving it out in alcohol,

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decomposed carefully with sulphuric acid, and the solution containing the free acid evaporated. (*Pharm. Journ.*, April 30th, 1887.) According to Dr. H. Stillmark, croton seeds contain *Ricin*, the poisonous principle of castor seeds. (*See Ricinus.*)

Toxicology.—The seeds are said to be used in Java for killing fish, and the oil has been shown to have the same effect upon the carnivora as upon man. When eaten, the seeds cause nausea and eructation, followed by flatulent distension of the abdomen, colic and diarrhœa. A single seed is reported to have proved fatal. The oil, in the dose of 1 drop, occasions more or less of an acrid and burning sensation in the fauces and œsophagus, a sense of warmth in the stomach, nausea, and sometimes vomiting. In an hour or two, some gurgling or slight colic is perceived in the bowels, followed somewhat suddenly by a watery stool with tenesmus, and heat about the anus. Within 24 hours eight or ten more stools follow, and there is but little general disturbance of the economy, except considerable weakness. Sometimes, instead of producing evacuations, the oil causes epigastric uneasiness and oppression, palpitation of the heart, headache, feverishness, perspiration, and sleep. It would appear that the acrid principle of the oil is not the sole cause of its cathartic operation, for even after being thoroughly washed with alcohol and rendered mild to the taste, as well as incapable of pustulating the skin, it is still strongly purgative. (*Stillé and Maisch.*) No cases of poisoning by croton seeds or oil in India appear to have been recorded.

During the expression of croton oil in India, the workmen, who are naked, with the exception of a cloth round the loins, have been observed to suffer from redness and irritation of the skin, evidently produced by some volatile constituent of the oil.

CROTON OBLONGIFOLUS, *Roxb.*

Hab.—Bengal, Silhet, Behar, Central India, Deccan Peninsula, Burma, and Ceylon. The root-bark, leaves, and fruit.

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Vernacular.—Chucka, Barágach (*Beng.*), Arjuna (*Hind.*), Kote, Putol (*Mal.*), Bhutan-kusam (*Tel.*), Ghanasura (*Mar.*), Gote (*Santal*), Kurti, Konya, Kuli, Poter (*Kol.*), Gonsurong (*Goa*).

History, Uses, &c.—Brandis has noticed the use of the bark, leaves and fruit of this plant in native medicine, and Dr. Irvine the use of the seeds as a purgative. From the *Dict. Econ. Prod. of India* we learn that the Santals use the bark and root as a purgative and alterative. We have been unable to find any notice of the drug in native works on Indian Materia Medica. Roxburgh, though he describes the tree as common in forests near Calcutta, is silent upon the subject. Dalzell and Gibson, in the *Bombay Flora* (p. 231), remark that "the plant is used medicinally by the natives to reduce swellings." The author of the *Mat. Med. of West. India* remarks:—"When on a visit to Goa in 1876, my attention was drawn by the native doctors to the root-bark of a small tree as being one of the most valuable medicines they possessed; this plant, unknown to me at the time, proved on subsequent investigation to be *C. oblongifolius*. The Goanese and inhabitants of the Southern Concan administer the bark in chronic enlargements of the liver and in remittent fever. In the former disease it is both taken internally and applied externally. As an application to sprains, bruises, rheumatic swellings, &c., it is in great request. In large doses it is said to be purgative." Flückiger and Hanbury (*Pharmacographia*, p. 510) state that the seeds are said to be sometimes substituted for those of *C. Tiglium*. The tree is rare in the Bombay Presidency, and has only been found in the Southern Concan, where it has a reputation as a remedy in snake-bites. In Goa it is more common.

Description.—Trunk straight; bark ash-coloured, and pretty smooth; leaves petioled, alternate, and thickly set about the ends of the branchlets, spreading or drooping, oblong, serrate, obtuse-pointed, very smooth on both sides, from six to twelve inches long, petioles round and smooth, with a lateral gland on each side of their apices; stipules small, caducous;

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racemes terminal, generally solitary, erect, shorter than the leaves; flowers solitary, a few female ones mixed with many male ones, small, of a pale yellowish-green; bracts 3-fold, one-flowered, on the inside of each of the small lateral bracts is a round permanent gland, as in *Sesamum indicum*; male calyx deeply 5-cleft, petals six, smaller than the calyx, very woolly; filaments twelve, distinct, nine in the circumference and three in the centre, woolly towards the base; female calyx and corol as in the male; stamens none; germ globular; styles three, each divided into two very long, variously bent segments; capsules globular, fleshy, six-furrowed, tricoccous. (*Roxb.*)

The root is twisted, often somewhat flattened, bark thickish, externally light-brown and scaly, internally yellowish, mottled with brown, substance compact and resinous, odour highly aromatic, taste peppery and camphoraceous. Wood white, soft.

Microscopic structure.—Sections of the bark show that the epidermis consists of about five rows of elongated cells placed horizontally; their walls are much thickened by a dark-brown deposit, which produces a patchwork appearance. The parenchyma is loaded with large globular or oval highly refractive bodies of a yellowish colour; there are also numerous dark purplish-brown particles, which are sometimes single but usually arranged in irregular concentric rows; they appear to be due to a deposit in the vascular system of a resinous nature.

Chemical composition.—The fresh root-bark was contused, and exhausted with warm 80 per cent. alcohol. The tincture was of a red colour. The alcoholic extract was mixed with water and agitated with petroleum ether, when reddish flocks separated. The solution was acid in reaction. The petroleum ether solution left on spontaneous evaporation a transparent viscid yellow residue, possessing a camphoraceous and pepper-like odour and taste. With the exception of some white flocks, the extract was soluble in cold alcohol with acid reaction; the solution afforded no coloration with ferric chloride.

The turbid aqueous solution, after separation of petroleum ether, was agitated with ether, without solution of the reddish

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flocks referred to as having separated on agitation with petroleum ether. The ether was separated from the turbid aqueous layer, and agitated with dilute sulphuric acid to separate any alkaloidal principle. The acid aqueous solution was then rendered alkaline and reagitated with ether. The ethereal solution left on spontaneous evaporation a slightly greenish transparent varnish-like residue, partly soluble in dilute sulphuric acid, the solution affording marked alkaloidal reactions. With Fröhde's reagent a dirty red to purple colour was observed, but no other special colour reactions were noted.

The original ethereal solution, after the agitation with sulphuric acid, left on spontaneous evaporation a brittle, transparent, yellow residue, soluble in alcohol with strong acid reaction, but affording no colour reaction with ferric salts. By the action of dilute aqueous caustic soda a part of the ethereal extract was dissolved with a deep port-wine red coloration. The portion insoluble in the alkaline solution was yellowish. The alkaline solution, on the addition of dilute acids, afforded yellow flocks, nearly wholly soluble in ether, and leaving a transparent yellow varnish on spontaneous evaporation, with a slightly bitter taste and acid reaction in alcoholic solution. The reddish flocks insoluble in petroleum and ordinary ether were separated from the original aqueous solution, and, when dry, formed a dirty reddish friable mass without taste or odour. In dilute alcohol this principle was soluble with acid reaction, the solution being of a port-wine colour, and possessing a slight spicy odour and taste. The solution, after being neutralized with ammonia, which deepened the tint, afforded a dirty plum-coloured precipitate with acetate of lead. To the original now clear aqueous solution of the alcohol extractive carbonate of soda was added, which caused a carmine-coloured precipitate, and the liquid agitated with ether, which failed to dissolve the precipitate. The ethereal solution left on evaporation a trace of residue, partly soluble in dilute suphuric acid, the acid solution reacting with alkaloidal reagents. With Fröhde's reagent the colour was dirty red to purple, and, like the principle first extracted by

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ether from the acid aqueous solution, yielding no other special colour reactions. The carmine flocks precipitated by the alkali, and which were insoluble in ether, were separated by filtration, the filtrate being of a logwood colour, and washed with cold water in which they were slightly soluble: on ignition an alkaline ash was left. By dilute acids the carmine precipitate was changed to salmon-yellow, the original colour being restored by alkalies. An aqueous solution gave a carmine-coloured precipitate with acetate of lead.

The original aqueous alkaline solution was lastly acidified with dilute sulphuric acid, which caused the separation of salmon-coloured flocks, and agitated with amylic alcohol. The amylic alcohol extract was reddish-yellow, becoming of a deep carmine hue with alkalies, and afforded a carmine precipitate with acetate of lead; acids destroyed the colour and caused a precipitate of salmon-coloured flocks practically insoluble in ether. By heating with zinc dust, the dried principles, which gave coloured precipitates with alkalies and acetate of lead, afforded no crystalline sublimates. The freshly contused root-bark afforded on steam distillation a small amount of a colourless volatile oil possessing a marked camphoraceous and pepper-like odour and taste.

In this investigation the principles which afforded coloured precipitates with alkalies were the most interesting, and these principles would appear to have been acids. It will be noted that the original aqueous solution of the alcoholic extract was not treated with any foreign acid prior to agitation with petroleum and ordinary ether. The flocks which separated during agitation with petroleum ether, and which were insoluble in ether, gave from an alcoholic solution a different coloured precipitate with acetate of lead, from the acids which were subsequently precipitated when the aqueous solution of the extract was rendered alkaline and agitated with ether, and when the alkaline solution was subsequently acidified before agitation with amylic alcohol. The last two acids referred to were, we consider, identical. The sodium salt of the acid was only slightly soluble in water, while the free acid was at best

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only slightly soluble in ether. The addition of sodic carbonate hence caused the precipitation of the greater part of the sodium salt, a small amount only remaining in solution. The subsequent addition of sulphuric acid decomposed the sodium salt in solution, with separation of the free acid in salmon-coloured flocks. As regards the identity of this acid with the one or ginally separated on agitation with petroleum ether, and ether, though the colour of the lead salt was different, it might have been due to the presence of foreign matters, and we are inclined to the view that these acid principles were similar. The alkaloidal principle from the first ether extract, and that obtained from the alkaline ether, were also probably identical.

ACALYPHA INDICA, *Linn.*

Fig.—*Wight Ic., t.* 877 ; *Rheede, Hort. Mal. x., t.* 81.

Hab.—Hotter parts of India.

ACALYPHA PANICULATA, *Miquel.*

Fig.—*Rheede, Hort. Mal. x., t.* 83.

Hab.—Deccan Peninsula. The herb.

Vernacular.—Kuppi, Khokali (*Hind., Mar.*), Dádaro (*Guz.*), Muktajuri, Shwet-basanta (*Beng.*), Kuppaimeni (*Tam.*), Kuppai-chettu, Murkanda-chettu, Puppanti, Harita-manjari (*Tel.*), Chálmári, Kuppi (*Can.*), Kuppa-mani (*Mal.*)

History, Uses, &c.—The medicinal properties of these plants are well known in India, but we have been unable to find any notice of them in the standard Sanskrit medical works.

Ainslie gives Aritamunjayrie as the Sanskrit name, which is evidently meant for Harita-manjari, "a plant with clusters of green flowers," a very appropriate name. Rheede describes two species of *Acalypha*, Cupameni (*A. indica*), and Wélia-cupameni (*A. paniculata*); he gives Manjara-sejári as the brahminical name of the first, and states that the juice, made into a liniment with oil, is used in rheumatism and venereal pains and eruptions, and, with the addition of lime, in skin diseases; that

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the root rubbed down with hot water is given as a cathartic; the leaves with water as a laxative, and in decoction to relieve the pain of earache. Of the second, he says that when rubbed down in rice-water and applied locally, it relieves pain, and that the juice with sesamum oil is useful in erysipelatous inflammation, hæmorrhoids, and the pain in the belly called by the Malabars *Guinao.* Ainslie says of *A. indica*:—"The root, leaves and tender shoots are all used in medicine by the Hindus. The powder of the dry leaves is given to children in worm cases, also a decoction of them with the addition of a little garlic. The juice of the same part of the plant, together with that of the tender shoots, is occasionally mixed with a small portion of margosa oil, and rubbed on the tongues of infants for the purpose of sickening them and clearing their stomachs of viscid phlegm. The hakims prescribe the Koopamaynee in consumption." In the *Pharmacopœia of India* (p. 205), the following reference to this plant by Dr. G. Bidie, of Madras, will be found:—"The expressed juice of the leaves is in great repute, wherever the plant grows, as an emetic for children, and is safe, certain, and speedy in its action. Like Ipecacuanha, it seems to have little tendency to act on the bowels or depress the vital powers, and it decidedly increases the secretion of the pulmonary organs. The dose of the expressed juice for an infant is a teaspoonful." Dr. Æ. Ross speaks highly of its use as an expectorant, ranking it in this respect with senega; he found it specially useful in the bronchitis of children. The purgative action of the root noticed by Rheede is confirmed by Dr. H. E. Busteed, who has used it as a laxative for children. In Bombay the plant has a reputation as an expectorant, hence the native name Khoklí (cough). Brigade-Surgeon Langley, in a communication to Dr. Watt, *Dict. Econ. Prod. Ind.*, Vol. I., writes:—"This plant is called in Canara *Chálmári* as well as Kuppi. The natives use it in congestive headaches: a piece of cotton is saturated with the expressed juice and inserted into each nostril; this relieves the head symptoms by causing hæmorrhage from the nose. The powder of the dry leaves is used in bedsores and wounds attacked by worms. In asthma

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and bronchitis I have employed it with benefit both for children and adults." Dr. Langley recommends a tincture of the fresh herb made with spirits of ether (3 ozs. to one pint), dose 20 to 60 minims, frequently repeated during the day, in honey; it acts as an expectorant and nauseant; in large doses it is emetic.

Description.—*A. indica.*—Stem erect, from 1 to 2 feet high, branchy, round, smooth; leaves scattered, petioled, ovate-cordate, 3-nerved, serrate, smooth, about 2 inches long and 1½ broad; petioles as long as the leaves; stipules small, subulate; spikes axillary, generally single, peduncled, erect, as long as the leaves, many-flowered, crowned with a body in the form of a cross, the base of which is surrounded with a 3-leaved calyx, the arms of the cross are tubular, with their mouths fringed, from the base of the cross on one side issues a style-like thread, with a fringed stigma, the body of the cross contains an ovate seed like substance; male flowers numerous, crowded round the upper part of the spike, calyx 4-leaved, leaflets cordate, filaments minute, numerous; female flowers below the male, remote; involucre cup-formed, with an opening on the inner side, striated, smooth, toothed, from 2 to 4-flowered; calyx 3-leaved. (*Roxb.*).

A. paniculata is a pubescent under-shrub or herb, with long-petioled ovate-acuminate leaves which are coarsely and equally serrated. The male flowers are in axillary, filiform spikes, and the female in axillary and terminal racemes or panicles; the bracts are minute and not enlarged in fruit. Capsule 1½ inch in diameter, 3-lobed, glandular, styles 3—7-partite.

Chemical composition.—The whole plant of *A. Indica* was dried at a low temperature, reduced to powder, and exhausted with 80 per cent. alcohol. The alcoholic extract was mixed with water, acidulated with sulphuric acid, and agitated with petroleum ether, and ether; the solution was then rendered alkaline and agitated with ether. During agitation with petroleum ether, a quantity of dark matter separated, which was partly soluble in ether, and in alkalies, and contained much colouring matter. The petroleum ether extract was dark and viscid, and had an

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aromatic odour, but did not yield any crystalline deposit on standing: in absolute alcohol it was soluble, and on spontaneous evaporation some yellow matter separated, which was destitute of crystalline structure on microscopic examination. The alcoholic solution had no special taste. The ether extract was yellow, and had an aromatic somewhat tea-like odour, and on standing became indistinctly crystalline. In warm water a portion dissolved, the solution possessing a strong acid reaction, and affording a dirty reddish coloration with ferric chloride: it did not precipitate gelatine, and gave no reaction with cyanide of potassium. The portion insoluble in water was dissolved by ammonia, affording a deep yellow coloured solution with a somewhat camphoraceous odour, the addition of acids causing the precipitation of whitish flocks.

The ether extract obtained from the original aqueous solution, after it had been rendered alkaline, contained a well-marked alkaloidal principle, which after purification afforded the following reactions: with Fröhde's reagent pinkish in the cold, dirty blue on warming; with sulphuric acid yellowish-red; no reaction with sulphuric acid and potassium bichromate; no reaction with ferric chloride; with nitric acid a yellow coloration; it was not precipitated by chromate of potash from an aqueous solution acidulated with sulphuric acid; taste harsh, without bitterness. We propose provisionally to call this principle *Acalyphine*.

Ainslie notices the use of **A. fruticosa**, Forsk., as a stomachic and alterative, an infusion of the leaves being used. (*Mat. Ind.*, ii. 388.)

TREWIA NUDIFLORA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1870—1; *Baill. Etud. Gen. Euphorb.*, *t.* 18, *f.* 18—23; *Rheede, Hort. Mal. i.*, *t.* 42.

Hab.—Hotter parts of India. The root.

Vernacular.—Pindára, Túmri, Bhilaura (*Hind.*), Pitúli (*Beng.*), Pitári, Sivani (*Mar.*), Kát-kumbla (*Can.*), Kánchi (*Mal.*).

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History, Uses, &c.—This tree bears the Sanskrit names of Pindára, Karaháta, and Kurangaka. It is described in the Nighantas as sweet and cooling, useful for the removal of swellings, bile and phlegm; the root is prescribed in gouty or rheumatic affections. Rheede describes the plant under the name of *Canschi*, and states that the root in decoction is used to relieve flatulence, and is applied locally in gout.

Description.—The root has a thickish bark, which is of a light-brown colour externally, nearly smooth, and studded here and there with a few small lenticular corky worts. On rubbing off the thin brown suberous layer a dull-red surface is exposed. The bark is fibrous and tough, and has a subaromatic, astringent and slightly bitter taste. The wood is white and soft.

Chemical composition.—The fresh root-bark was contused and exhausted with 80 per cent. alcohol; the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated successively with petroleum ether, and ether; then rendered alkaline with sodic carbonate and agitated first with ether and lastly with amylic alcohol.

During agitation with petroleum ether a large amount of resinous matter separated. The petroleum ether extract contained a large amount of colouring matter and had a persistent bitter taste. By agitation with water acidulated with sulphuric acid and ether, it was separated into two portions, a portion soluble in ether, which contained the greater part of the colouring matter, and some fat; while the aqueous acid solution held in suspension yellowish flocks consisting of a neutral resinous principle.

The acid ether extract was small in amount, partly soluble in water with acid reaction; the solution giving a blue-black coloration with ferric chloride, and precipitating gelatine, but giving no reaction with potassium cyanide. On adding ammonia to the ether extract, a yellow to brown sherry colour was produced. The ammoniacal solution was agitated with ether, which removed à small amount of whitish resinous

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matter, insoluble in water and containing no alkaloidal principle. The ammoniacal solution contained resinous matter.

The alkaline ether extract contained traces of an alkaloid, which, after purification, gave a very faint-yellow coloration with Fröhde's reagent in the cold, the colour becoming faintly greenish on warming; concentrated nitric acid gave a slight yellow coloration.

The amylic alcohol extract contained some resinous matter, and an alkaloidal principle in larger amount than was present in the ether extract, but which we consider to be identical.

The resinous matter which separated on originally shaking the alcoholic extract with petroleum ether, and which was insoluble in it, also failed to dissolve in ether; it was also insoluble in aqueous sodic carbonate, and had the properties of phlobaphene.

MALLOTUS PHILLIPPINENSIS, *Müll-Arg.*

Fig.—*Bentl. and Trim.*, *t.* 236; *Bedd. Fl. Sylv.*, *t.* 289; *Roxb. Cor. Pl. ii.*, *t.* 168; *Rheede, Hort. Mal. v.*, 21, 24.

Hab.—Throughout Tropical India. The glands and leaves.

Vernacular.—Kapála, Kamála (*Hind.*), Kamila (*Beng.*), Kapila, Kapita, Kamila (*Mar.*), Vasáré, Chandrahittu (*Can.*), Kámpilla (*Guz.*), Kapli, Kapila (*Tam.*), Kápila-pod (*Tel.*).

History, Uses, &c.—The glandular powder obtained from this plant has been used as a dye in India from a very remote period. It was probably collected, as at the present time, by the aboriginal tribes, who call it *Ruhin*, before the Hindus invaded India. In Sanskrit it is known as Kampilla, and bears the synonyms of Rochanika, Rochana-rakta and Lohita-rakta, in allusion to its red colour. In the Nighantas it is described as useful in removing phlegm, bile, stone, worms, enlarged glands, boils, &c., and the leaves are said to be astringent and cooling. In the *Bhavaprakása* one tola with treacle is said to kill and expel all intestinal worms. It

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is also prescribed for worms in combination with the seeds of *Embelia Ribes* (vaverang), chebulic myrobalans, carbonate of potash, and rock salt. (*Chakradatta.*) The Arabs became acquainted with Kampilla at an early date, and through them it appears to have reached Europe, and to have been known to the later Greek physicians about the 7th century. Ibn Massowiyeh, physician to the Caliph Haroon-el-Raschid, speaks of it as highly astringent, a good anthelmintic, and a useful application to moist eruptions of the skin, which it soon dries up. It is also mentioned by Rázi, Tamimi, Baghdádi, Ibn Sina, Ibn Baitar and others, all of whom appear to have been in much doubt as to its nature, but distinguish it from *Wars*, a product of Arabia, the source of which they were acquainted with. Ibn Sina says of Kanbíl:—"It is in grains like sand, red, but less so than *Wars*, hot and dry in the third degree; Ibn Massowiyeh considers to be highly astringent; it kills worms and flukes of the intestines and expels them." Of *Wars*, he says:—"It is a substance like powdered saffron, of an intense red colour (احمر قانی), brought for sale from Yemen; they say that it is scraped from a plant; it is hot and dry in the third degree, astringent; a useful application to pimples, freckles, &c." (A number of skin eruptions are named, the exact nature of which is doubtful.)

The author of the *Makhzan*, who wrote in India (1770), is strangely ignorant of the source of this drug. He says:—"Kinbíl is an Arabic form of the Persian Kampilla and Hindi Kamila"; he then recapitulates the various opinions held as to the source of the drug, and concludes by saying: "I have heard that it is the pulp of the fruit of a mountain-tree like the *Ma'asfar*, but its leaves are rather larger, and it is armed with long stiff thorns, and has fruit like a lime, which is green when young and red when ripe; when ripe it bursts open and a dull-red substance escapes and falls on the ground: this is collected, and is Kinbíl." Regarding its properties, he says that in doses of from 1 to 2 dirhems rubbed into an emulsion with any suitable vehicle it expels all kinds of intestinal worms, and at the same time acts as a purgative. Speaking

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of *Wars*, the same author says that there is a black kind, which comes from Ethiopia, and is called '*Habshi*,' and a dull-red kind which is called Indian, and is the worst (as a dye); he concludes by saying the seeds of the *Wars* are like Másh (*Phaseolus radiatus*). There is no mention of its use as an anthelmintic; it is described as an aphrodisiac, lithontriptic, and remedy for ringworm, pityriasis and freckles. Sprengel thought that the source of *Wars* was *Memecylon tinctorium.* (Confer. *Hist. Med.*, *t.* II., p. 444, ed. tert.; also *Hist. rei Herb.*, *t.* I., p. 258.)

Rheede first figured and described the plant; he states that the leaves, fruit and root with honey are applied to poisoned bites, bruises, &c. Buchanan (*Journey through Mysore in* 1801) notices Kamála; it has also been noticed by Ainslie, Roxburgh, and Royle, but Mackinnon of Bengal, in 1858, was the first to introduce it into European practice in India; since then it has been used with success by many medical men in India and Europe. Previous to this, Vaughan had sent Kamála to Hanbury from Aden under the name of *Wars*, and had described its use as a dye, and as a remedy in certain skin diseases. (*Pharm. Journ.*, Vol. xii., p. 386, 1853.) The true Arabian *Wars* does not appear to have attracted attention in Europe until 1867, when it was imported by Messrs. Allen and Hanburys of London. The source of *Wars* remained unknown until 1884, when it was ascertained to be the glands of the pod of *Flemingia Grahamiana*, a leguminous plant common in Arabia and India. (*See Flemingia.)*

As noticed in the *Pharmacographia*, the names Kanbíl and Kamála are not in use in the bazars at Aden; the Indian Kamála being now commonly known there as *Wars.*

The dose of Kamála is from one to two drachms, or one to three fluid drachms of a saturated tincture may be employed; it does not cause much nausea, colic, or purging. The parasite is generally discharged dead, and it appears to be equally efficacious in removing all kinds of worms. The dose should be repeated several times at intervals of about three hours.

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Description.—Kamála is a red powder, which varies in depth of colour, mixed with it are greenish-yellow fragments of the capsule of the plant; like lycopodium it is inflammable and resists admixture with water. Alcohol and ether dissolve a considerable portion of it, and the solution poured in water emits a melon-like odour.

Microscopic structure.—Each grain of Kamála is a spherical body, consisting of an outer delicate membrane within which may be seen a structureless mass of yellow colour, in which are embedded numerous club-shaped cells, arranged with their thick ends outwards; in order to examine these cells the drug must be exhausted of its resin by alcohol or potash. The hairs which are found mixed with the glands are stellate, each hair being one-celled and thick-walled.

Chemical composition.—Pure Kamála contains only between ·5 and 3·5 per cent. of moisture, and yields to ether, alcohol, amyl alcohol, glacial acetic acid, or carbon disulphide, about 80 per cent. of resin, which is also soluble in alkalies, but not in benzine, and whose alcoholic solution is coloured dingy-green by ferric chloride. (*Flückiger.*) Leube (1860) analyzed a sample of Kamála which yielded nearly 29 per cent. of ash, 47·6 of resin, and 19·7 of other soluble matters, consisting of citric, oxalic, and tannic acids, gums, &c. Cold alcohol dissolved a resin, $C^{15}H^{18}O^{4}$, fusible at 80° C., and left a more sparingly soluble resin, $C^{8}H^{12}O^{5}$, melting at 191° C. Both resins are brittle, reddish-yellow, soluble in alkalies with a red colour, not altered by dilute acids, and when treated with nitric acid yield oxalic acid. Leube could not obtain Anderson's *Rottlerin*, $C^{11}H^{10}O^{3}$ or $C^{22}H^{20}O^{6}$ (1855), which crystallized from the concentrated ethereal tincture in yellow silky needles. Groves (1872) ascertained that it is easily modified by exposure to air, and is consequently obtained only from the recent drug. Flückiger subsequently observed that on being fused with potassa, rottlerin yields *paraoxybenzoic acid.* Anderson's *resinous colouring matter* has the compositiom $C^{30}H^{30}O^{7}$, melts at 100° C., is easily soluble in alcohol and ether, and yields with lead acetate

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an orange-coloured precipitate. By treating Kamála with boiling alcohol, and cooling, amorphous floccules of the composition $C^{20}H^{34}O^{4}$ are obtained, which are sparingly soluble in cold alcohol and ether, and are not precipitated by lead or silver salts. (*National Dispensatory.*)

Messrs. A. G. Perkin and W. H. Perkin, Junr. (*Berichte*, 1886), have recently separated from Kamála a substance which they name *Mallotoxin*, $C^{11}H^{10}O^{3}$ or $C^{18}H^{16}O^{5}$. It was obtained by shaking powdered Kamála with bisulphide of carbon, evaporating the solution, and treating the residue with just enough bisulphide of carbon to remove the resinous impurities. It was finally purified by crystallization from benzine or toluene. It formed small flesh-coloured needles, soluble in alkalies, alcohol and acetic acid, but insoluble in water. It appears to be identical with the rottlerin of Anderson. Later still, L. Jarvein (*Ber.*, xx., 182) obtained a yellow crystalline substance from Kamála, melting at 200°, to which he gave the same name and formula as Anderson's rottlerin.

The bark of this tree is astringent, and Professor Hummel found it to contain 6·5 per cent. of tannin.

Carefully selected, Kamála, according to P. Siedler, will not contain more than 1·5 per cent. of ash, whilst the commercial article yields from 21·8 to 49·1 per cent. By sifting, fractions may be obtained containing as low as 5·2 and as high as 25 per cent. High percentage of mineral matter may be due to careless collection, or to adulteration; in the latter case, the ash may range from 50 to 80 per cent. The percentage of ash has notably increased of late, and by sifting it is often impossible to get the drug containing less than 14 per cent. of ash. Of 45 samples examined by the author, only three contained less than 6 per cent. (*Pharm. Zeitg.*, 1891, 162.)

Commerce.—Kamála is collected in the N.-W. Provinces, the Concan and Madras, and is distinguished by the collectors as of two qualities, *Kapila* and *Kapili*; the latter is the best, and is obtained by shaking the fruit only in a basket to separate the glands. Kapila consists of the glands and other parts of the

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plant, and has a greenish tinge. The collection of the drug is an industry of the hill Khonds in Ganjam, who sell a few measures for a few measures of rice or a yard of cloth.

The average value of the best red Kamála is Rs. 11 per maund of 41 lbs. The high winds laden with dust, which often prevail in India, cause a certain amount of impurity in the drug from the adherence of dust to the capsules and leaves of the plant. Native dealers test the drug by taking it up on the moistened finger and rubbing it firmly upon a piece of white paper; if of good quality, a smooth paste is formed and the paper is stained of a bright-yellow colour.

RICINUS COMMUNIS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 237; *Sibth. Fl. Græc. x.*, *t.* 952; *Hayne, Arneigew. x.*, *t.* 48; *Rheede, Hort. Mal. ii.*, *t.* 32. Castor plant (*Eng.*), Ricin commun (*Fr.*).

Hab.—Africa? Cultivated throughout India. The leaves, seeds, root, and oil.

Vernacular.—Arandi (*Hind.*), Erandi (*Mar.*), Bherenda (*Beng.*), Amanakkam-chedi (*Tam.*), Amudapu-chettu (*Tel.*), Avanakku (*Mal.*), Karala-gida (*Can.*), Erando (*Guz.*).

History, Uses, &c.—The Castor plant is called in Sanskrit Eranda, Ruvu, Ruvuka and Uruvuka, and the red variety Raktairanda; the root and the oil obtained from the seeds have been used medicinally by the Hindus from a very remote period, and are mentioned by Susruta.

Both root and oil are described as purgative and useful in costiveness, flatulence, rheumatism, fever and inflammatory affections; on account of its efficacy in rheumatism the plan bears the synonym of Vátári (váta-ári). As a purgative the oil is directed to be taken with cow's urine or an infusion of ginger or the decoction of the ten roots known as *dasamula* (see Vol. I., p. 243). The seeds freed from the husks and germs, and boiled in milk and water, form a decoction which is given in rheumatism; a decoction of the root with carbonate of potash

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is also prescribed, and most compound medicines given in rheumatic and neuralgic affections contain the root. The leaves are applied to the breast to stop the secretion of milk, and, boiled with the root in goat's milk and water, they are used as a local application in ophthalmia. When applied to the abdomen they are popularly thought to promote the menstrual flow; in *Govardhana* (203), the *halikavadhu*, or "peasant woman," is represented as lying in pain upon the leaves of the *Eranda*.

In the proverbial language of the Indians the Castor plant is emblematic of frailty; they say:—Naukri arand ki jar hai (service is like the root of the Castor plant). The Arabs appear to have first become acquainted with the tree in India, as they call the seeds Simsim-el-hindi, "Indian Sesamum," and the plant Khirvaa (خروع), a word which signifies any weak or frail plant; the properties they attribute to it are also those mentioned by Sanskrit writers. Again, in the *Saptasataka* of Hála, we find the large and swelling breasts of the peasant girl likened to the Eranda leaf, and in Arabic we have the expression امراة خروعة applied to a beautiful and tender girl.

R. communis is the Bidanjir and Kinnatu of the Persians; it also bears various local names, such as Gerchak in the Shahpur District, and Buzanjir, "goat's fig," in Khorasan.

Aitchison notices its cultivation round the borders of fields in the latter province, and in the Harirud District, for the sake of the oil which is used as a lamp oil, and says that the peasantry are unacquainted with its purgative properties. The plant was cultivated in Southern Europe at a very early date; it is the κίκι of Herodotus, the κρότων of Theophrastus (H.P.i.,16; C.P. ii.), and the κίκι or κρότων of Dioscorides (iv., 158), who observes that the name κρότων is given to the seed on account of its resemblance to an insect known by that name (*Ixodes Ricinus*, Latr.). He also notices Castor oil and its medicinal use. It is the Ricinus or Cicus of Pliny (15, 7), "a tree which grows in Egypt in great abundance; by some it is known as croton, by others as sili, and by others, again, as wild sesamum: it is

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not so very long since this tree was first introduced here. Eaten with food the oil is repulsive, but it is very useful for burning in lamps."

The Jews and Abyssinian Christians say that it was under this tree that Jonah sat, but in the English version the Hebrew word "*Kikajon*" is translated "gourd." For a history of the plant in Europe, the *Pharmacographia* may be consulted.

Mahometan medical writers describe two kinds, red and white: the red is said to be the most active. They consider the oil a powerful resolvent and purgative of cold humors, and prescribe it in palsy, asthma, colds, colic, flatulence, rheumatism, dropsy and amenorrhœa; of the seeds, 10 kernels rubbed down with honey are sufficient as a purge. A poultice of the crushed seeds is used to reduce gouty and rheumatic swellings, and inflammation of the breasts of women during lactation. The leaves have similar properties, but in a less degree. The fresh juice is used as an emetic in poisoning by opium and other narcotics; made into a poultice with barley meal it is applied to inflammatory affections of the eye. The root-bark is used as a purgative and alterative in chronic enlargements and skin diseases; it is also applied externally.

In modern medicine Castor oil is much valued as a non-irritant purgative; a drop is sometimes dropped into the eye to allay irritation, and, strange to say, the leaves are applied locally in Europe to promote the secretion of milk, whereas in India the native practice of applying them to stop the secretion of milk is recognised in the Government hospitals under European superintendence. A fluid extract of the leaves has also been recommended in Europe as a lactagogue. As a purgative the oil is best administered in the early morning on an empty stomach, when about one drachm will usually be found sufficient, at other times at least half an ounce will be required. Various fluids have been recommended to conceal the taste of the oil, such as brandy, peppermint water, &c., but the decoction of fresh ginger, as used in India, is, we think, the best vehicle. The above remarks apply to cold drawn oil; the bazar oil extracted

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by boiling is more active, and, as it is not always carefully prepared, it may contain the acrid principle of the seed and give rise to disagreeable symptoms. The alleged antirheumatic properties of the plant so insisted upon by Hindu and Mahometan physicians are worthy of being tested by careful clinical observation.

M. H. Meyer (*Pharm. Zeitsch. f. Russland*, xxx., p. 282, 1891), in order to decide the question as to the purgative properties of ricinoleic acid, prepared that substance perfectly pure, also its glyceride, and ricinelaïdic acid. All these preparations were administered to cats, and acted as purgatives. The author concludes that there is no reason to suppose that Castor oil contains any purgative principle other than ricinoleic acid.

Dr. H. Stillmark has discovered in the seeds an albuminoid body which he has named "*Ricin.*" This, however, does not appear to be the purgative principle. Its action, whether given by the mouth or hypodermically, is to produce hæmorrhagic inflammation of the gastro-intestinal tract, affecting primarily the small intestines, and probably obstructing the bile duct, since there is usually extreme fullness of the gall bladder; the inflammation also extends to the vesical mucous membrane. Diarrhœa is by no means constant. The drowsiness and convulsions which occurred in some of his experiments on animals he attributes to possible thrombosis of the cerebral vessels. The lethal dose of ricin for man he calculates to be 6·0 milligrams for a man weighing 60 kilograms, this generally being equal to about ten ordinary seeds, although Christison once had a fatal case, where only three seeds had been swallowed, and, on the other hand, a case is on record in which a person who had eaten 17 seeds, recovered.

Ricin appears to have a peculiar effect upon blood, causing a rapid conglomeration of the red corpuscules, together with the formation of a substance like fibrin. One part of ricin to 60,000 of defibrinated blood is sufficient to cause a separation of the serum, so that the latter is capable of being passed through

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a filter. Crotonoleic acid, which exists in croton seeds, was found to be quite distinct from ricin.

The results obtained by Dr. Stillmark find further confirmation in a note in the *Medical Recorder* (July, p. 299), in which it is stated that fifteen children, under six years of age, poisoned by eating castor seeds, suffered from severe vomiting and prostration, but not from catharsis.

Ehrlich (*Deutsche Med. Wochenschr.*, No. 32, p. 976, 1891) reports some interesting experiments with ricin. He found that injected into the veins of animals, it is fatal in doses of three milligrams per kilo of body-weight; taken internally it is a hundred times less active, but still so poisonous that 0·18 gram is a fatal dose for an adult man. He found different animals to be unequally affected by it; guinea pigs were especially susceptible to the poison, but white mice much less so. The symptoms were diarrhœa and prostration: on *post-mortem* examination the appearances in some cases were such as are seen in cholera, but more frequently there was a hæmorrhagic condition of the intestines and often of the subcutaneous cellular tissue.

Ehrlich also succeeded in rendering animals insusceptible to the poison by administering gradually increasing doses internally: at the end of two months of this treatment he found that mice could bear a dose of 5 decigrams of ricin (sufficient to kill an adult man), the fatal dose for an unprotected mouse being 35 milligrams.

The immunity obtained was still more marked in experiments on the conjunctiva; under ordinary circumstances touching the membrane with a 1 per cent. solution of ricin produced intense inflammation, but after several weeks of protective treatment the strongest solution could be freely applied without producing any effect.

The establishment of the immunity appears to commence suddenly on the sixth day, and continues to increase from that time. The author insists upon the similarity between this

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sudden immunity and the critical subsidence of fever in certain acute diseases, such as pneumonia, measles, &c., which he considers may also be regarded as indicating the establishment of an immunity in those diseases.

Animals in which an immunity to the ricin poison had been established, were found, six months after the cessation of all treatment, to be incapable of being affected by the poison. Ehrlich has also made similar experiments with *abrin*, the active principle of *Abrus precatorius*, which he reserves for early publication.

Description.—There are many varieties of the plant which have been produced by cultivation; they may be divided into the large red-seeded kinds, and those with grey seeds marked with brown blotches; the latter are preferred for medicinal use.

The roots are tolerably straight, and give off a few rootlets; they are covered by a light-brown bark, nearly smooth, but marked with little transverse warty ridges. The wood is white and soft. The bark has an acrid taste.

The seeds are contained in a tricoccous capsule, one in each cell; they are oblong, from ¼ to ½ an inch long and about ⅓ of an inch broad, the dorsal surface is more arched than the ventral. The apex is somewhat pointed, below it is a tumid caruncula, on the removal of which a dark depressed cicatrix is seen. The testa is grey, marked with brown blotches. The kernel is enclosed in a delicate white membrane, and consists of a copious white albumen, in the axis of which are situated two leafy cotyledons and a short stout radicle.

Microscopic structure.—The epidermis of the seeds is composed of tabular cells, which are here and there coloured in patches which correspond to the spots on the seed. The testa consists of cylindrical cells in close apposition. The kernel is a mass of closely-packed cells with granular contents, but if water is brought in contact with the section, oil globules separate from the albumen. In the latter may be demonstrated the

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Aleurone crystals which are found in many seeds. (*Sachs Lehrbuch der Botanik*, p. 554.) The root-bark shows numerous cells filled with a yellow refractive substance which appears to be resinous; in other respects it is not remarkable.

Chemical composition.—The most important constituent of the seeds is the fixed oil called castor oil, of which the peeled kernels afford at most half of their weight.

The authors of the *Pharmacographia* say:—

"The castor oil of commerce has a sp. gr. of about 0·96, usually a pale yellow tint, a viscid consistence, and a very slight yet rather mawkish odour and taste. Exposed to cold, it does not in general entirely solidify until the temperature reaches —18°C. In thin layers it dries up to a varnish-like film.

"Castor oil is distinguished by its power of mixing in all proportions with glacial acetic acid or absolute alcohol. It is even soluble in four parts of spirit of wine (·838) at 15° C., and mixes without turbidity with an equal weight of the same solvent at 25° C. The commercial varieties of the oil, however, differ considerably in these as well as in some other respects.

"The optical properties of the oil demand further investigation, as we have found that some samples deviate the ray of polarized light to the right and others to the left.

"By saponification, castor oil yields several fatty acids, one of which appears to be *Palmitic Acid.* Another acid (peculiar to the oil) is *Ricinoleic Acid,* $C^{18}H^{24}O^{3}$; it is solid below 0° C.; does not solidify in contact with the air by absorption of oxygen, and is not homologous with oleic or linoleic acid, neither of which is found in castor oil. Castor oil is nevertheless thickened, if 6 parts of it are warmed with 1 part of starch and 5 of nitric acid (sp. gr. 1·25), *Ricinelaïdin* being thus formed. From this, *Ricinelaïdic Acid* may easily be obtained in brilliant crystals.

"As to the albuminoid matter of the seeds, Fleury (1865) obtained 3·23 per cent. of nitrogen, which would answer to

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about 20 per cent. of such substances. The same chemist further extracted 46·6 per cent. of fixed oil, 2·2 of sugar and mucilage, besides 18 per cent. of cellulose.

"Tuson, in 1864, by exhausting castor oil seeds with boiling water, obtained from them an alkaloid which he named *Ricinine.* He states that it crystallizes in rectangular prisms and tables, which ,when heated, fuse, and, upon cooling, solidify as a crystalline mass; the crystals may even be sublimed. Ricinine dissolves readily in water or alcohol, less freely in ether or benzol. With mercuric chloride, it combines to form tufts of silky crystals, soluble in water or alcohol. Werner (1869), on repeating Tuson's process on 30 lbs. of Italian castor oil seeds, also obtained a crop of crystals, which in appearance and solubility had many of the characters ascribed to ricinine, but differed in the essential point that when incinerated they left a residuum of magnesia. Werner regarded them as the magnesium salt of a new acid. Tuson repudiates the suspicion that ricinine may be identical with Werner's magnesium compound. E. S. Wayne of Cincinnati (1874) found in the leaves of Ricinus a substance apparently identical with Tuson's ricinine; but he considers that it has no claim to be called an alkaloid.

"The testa of castor oil seeds afforded us 10·7 per cent. of ash, one-tenth of which we found to consist of silica. The ash of the kernel previously dried at 100°C., amounts to only 3·5 per cent." (*Op. cit.*, 2nd Ed., p. 569.)

K. Hazura and A. Grüssner (*Moniteur Scient.*, Ap. 1889) infer from their experiments that the liquid acid of castor oil is not a single compound, as has been hitherto supposed, but a mixture of two isomeric acids of the composition $C^{18}H^{34}O^{3}$, one of which, ricinoleic acid, yields on oxidation trioxystearic acid, whilst the other, ricinisoleic acid, yields isotrioxystearic acid. The proportion of these acids is about 1 of the former to 2 of the latter. As no dioxystearic acid has been obtained from the oxidation of the liquid acids of castor oil, it may be concluded that of all the fatty oils hitherto examined, castor oil is the only one which contains no oleine.

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The leaves, stem, and root of *R. communis* contain the same active principles as the seeds; a proximate analysis by A. L. Beck (*Amer. Journn. Pharm.*, 1888) gave the following results:—

	Leaves.	Stem.	Root.
Extracted by petroleum spirit............	4·582	0·275	0·380
" " ether	2·575	0·316	0·338
" " alcohol	2·490	0·833	......
" " water	12·699	......	......
" " diluted Na OH	1·200	......	......
" " " H Cl..............	2·193	......	......
Loss by chlorine	5·440	......	......
Residues, cellulose, &c.	43·590	......	......
Ash..	11·220	5·466	7·050
Moisture	12·700	6·100	7·083
Loss	1·311	......	......

The poisonous principle present in castor oil seeds has been variously represented as an alkaloid, a glucoside, and an organic acid. But as the result of an exhaustive chemical and pharmacological investigation, recorded in a lengthy treatise (*Arbeit. d. Pharmakol. Inst. Dorpat*, Part III., p. 59), Herr Stillmark has come to the conclusion that it is an albuminoid body, identical with the "B. phytalbumose," separated from the dried juice of *Carica Papaya* by Sidney Martin, and belonging to the class of unformed ferments. This substance, which he has named "ricin," may be prepared by exhausting well-pressed peeled Ricinus seeds, reduced to powder, with a 10 per cent. solution of sodium chloride, saturating the clear percolate at the ordinary temperature with magnesium sulphate and sodium sulphate, and keeping it in a cool place, when, besides large crystals of the two sulphates, a white precipitate, easily separable from these, is formed. This is placed in a dialyser, with frequent changes of water, for six days, after which the residue is removed and dried over sulphuric acid, and can then be reduced to a snow-white powder, which still contains 10 to 20 per cent. of sulphate. This substance is a most powerful poison,

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exercising a remarkable power of coagulation, so that the blood coming into contact with a minute quantity that has been absorbed is coagulated, blocks the lumina of the intestinal capillaries, and causes thrombosis and ecchymosis. Even when introduced subcutaneously, the principal action of the poison appears to occur in the intestinal canal, and not at the place of injection. The lethal dose for a man weighing sixty kilograms is estimated as 0·18 gram, and it is stated that this quantity is contained in the press-cake from 3 grams of peeled seeds. In view of this fact, that the residue from the pressing of castor oil contains such large quantities of a tasteless poison exceeding arsenic in toxic power, and at present not to be detected in the body by any known method, Herr Stillmark raises the question, whether it should not be made compulsory upon manufacturers to burn the cake, or render it harmless by a process of boiling that would destroy the ferment. Experiments were also made upon the seeds of nine other species of Ricinus, as well as those of *Croton Tiglium* and *Jatropha Curcas*, and in each case a poisonous albuminoid substance was separated, similar to, if not identical with, ricin, and belonging to the class of ferments. It is pointed out by the author that the coagulating power of ricin explains the external application in some countries of crushed Ricinus seeds as a hæmostatic. (*Pharm. Journ.*, Nov. 2nd, 1889.)

Commerce.—Several varieties of the castor plant are cultivated in India: they may be divided into large-seeded and small-seeded. The seeds of the latter variety only are exported, those of the former being used in India for the preparation of an inferior kind of oil which is used for lubricating machinery, &c.

The exports of seed from 1885-86 to 1888-89 were:—

1885-86	34,000	tons,	valued at	30	lakhs	of Rupees.
1886-87	31,000	„	„	29	„	„
1887-88	36,000	„	„	34	„	„
1888-89	29,000	„	„	31	„	„

Most of the castor seed goes to Italy.

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The exports of oil, mostly from Bengal, during the same period, were :—

1885-86...2·2	millions of gallons,	valued	at	22	lakhs	of Rupees.
1886–87...2·7	„	„	„	27	„	„
1887–88...2·7	„	„	„	26	„	„
1888–89...2·7	„	„	„	26	„	„

Almost the whole of the oil goes to England.

Ricin has been introduced into commerce by Merck of Darmstadt.

BALIOSPERMUM AXILLARE, *Blume.*

Fig.—*Wight Ic., t.* 1885; *Rheede, Hort. Mal. x., t.* 76.

Hab.—Tropical and Subtropical Himalaya. Deccan Peninsula. The root and seeds.

Vernacular.—Danti (*Hind., Beng., Mar., Guz.*), Kondá-ámádam (*Tel.*), Nága-danti (*Tam., Mal.*).

History, Uses, &c.—This plant, in Sanskrit Danti, Nágádanti or Danta-mulika, with numerous synonyms, such as Upachitra, Makulaka, &c., is much used in Hindu medicine where purgation is indicated, the root being generally prescribed. The seeds (Danti-vija) are also used, and are sometimes sold in the shops as croton seeds. The following formula from Chakradatta will show how the root is prescribed:—

"*Dánti haritaki.*—Take 25 large chebulic myrobalans and enclose them in a piece of cloth, then take of the roots of *Baliospermum axillare* and *Ipomœa Turpethum*, each 200 tolas, water 64 seers, boil them together till the water is reduced to 8 seers. Strain the decoction, take out the chebulic myrobalans and fry them in 32 tolas of sesamum oil. To the strained decoction add 200 tolas of old treacle, then boil till reduced to the proper consistence for a confection. Now add to the mass the following substances: powdered root of *Ipomœa Turpethum* 32 tolas, long pepper and ginger, each 8 tolás, and stir them

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well; when cool, add 32 tolas of honey; cinnamon, cardamoms, tejpat leaves, and the flowers of *Mesua ferrea*, each 8 tolas, and prepare a confection. The chebulic myrobalans should be kept embedded in the medicine. Two tolas of the confection and one of the myrobalans are to be taken every morning."

A more simple formula from the Bhavaprakasa is the *Gudáshtaka*. Take of *danti*, *trivrit* (*Ipomœa Turpethum*), and plumbago root, black pepper, ginger and long pepper root, equal parts in fine powder; treacle, equal in weight to all the other ingredients, and mix. Dose about a tola every morning, in flatulence, anasarca, jaundice, &c.

Rheede says of Danti:—Folia, radix atque fructus, tanta purgandi pollent energia, ut solus odor catharsin excitet: folia extrinsice applicata articulari medentur morbo."

Roxburgh remarks:—"The seeds are esteemed by the natives a good purgative; they administer one seed bruised up with water for every evacuation they wish the patient to have. There would appear to be little doubt that the seeds of this plant were the original Dand of the Arabian physicians, but were subsequently superseded by those of *Croton Tiglium*, as has been the case in India.

Description.—Roots nearly straight, seldom branched, about as thick as the finger; bark brown, scabrous; wood yellowish-white, soft and tough. The outer layer of the bark consists of several rows of brick-shaped brown cells, mostly empty, but some of them containing a dark reddish-brown resin; within this the parenchyma is so loaded with conglomerate raphides that its structure is with difficulty seen; it has many cells filled with resin as in the suber, and very numerous yellow liber cells. The wood is loaded with starch.

The seeds weigh about one and a half grains each, and are exactly similar to very small castor seeds.

Commerce.—The seeds are no longer found in the bazars, having been superseded by the imported croton seeds; the root is also difficult to obtain, that sold in the shops as Danti-mul being usually the root of *Ricinus communis*.

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TRAGIA INVOLUCRATA, *Linn.*

Fig.—*Burm. Zeyl., t.* 92; *Rheede, Hort. Mal. ii., t.* 39; var. *cannabina, A. Juss. Tent. Euphorb., t.* 15, 49 B.

Hab.—Throughout India. The root.

Vernacular.—Barhanta (*Hind.*), Bichati (*Beng.*), Kanchuri, (*Tam.*), Kánchkuri, Khájkolti (*Mar.*), Dulaghondi (*Tel.*), Haligilu (*Can.*).

History, Uses, &c.—This very variable plant, of which four varieties are described in the *Flora of British India,* is the Vrischikáli of the Rája Nirghanta, where it is said to bear the same name in Marathi and to be called Haligilu in Canarese. It is recommended in bilious fever, and as a diuretic and alterative. Rheede says of it:—"Conducit in febre ossium, ac servit pro pruritu corporis; in decocto data urinam suppressam movet." He also notices its use on the doctrine of signatures as a remedy for the sting of the Ray fish.

Ainslie (ii., 61 and 389) says:—"The root, which is sometimes called 'Coorundootievayr,' has in its dried state but little taste or smell, though in its more succulent condition it has a rather pleasant odour; it is considered as diaphoretic and alterative, and is prescribed in decoction, together with other articles of like virtues, to correct the habit in cases of *mayghúm* (cachexia), and in old venereal complaints, attended with anomalous symptoms; an infusion of it is also given as a drink in ardent fever, in the quantity of half a teacupful twice daily."

In the Concan the roots of these plants are used to aid the extraction of Guinea-worm, a paste made from them being applied to the part. A paste of the roots with Tulsi juice is also used as a cure for itchy eruption of the skin. In Tanjore, the root is boiled with cow's milk and taken at bedtime for dry cough.

Description.—Shrubby, climbing, 4 to 5 feet high; leaves petioled, 3-divided, serrate, hairy, 2 to 4 inches long; stipules half lanceolate; racemes erect, many-flowered; male flowers numerous on the upper part of the raceme, very small,

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yellow, each with three bracts; female flowers beneath the male, two on each raceme, with the calyx leaflets pinnatifid. The plant stings like the nettle. For a description of its varieties, the reader is referred to the *Flora of British India*.

EXCÆCARIA AGALLOCHA, *Linn.*

Fig.—*Wight Ic., t.* 1865 *B; Rheede, Hort. Mal. v., t.* 45. Blinding tree, Tiger's milk tree (*Eng.*), Arbre aveuglant (*Fr.*).

Hab.—Tidal forests of India. The juice and cork.

Vernacular.—Gaoura, Uguru, Gangwa, Geria (*Beng.*), Chilla (*Tel.*), Haro (*Can.*), Gevá, Phungali, Hura (*Mar.*), Tillai-cheddi (*Tam.*).

History, Uses, &c.—This tree was named *Agallocha* by the old botanists, from a supposition that a kind of Aloe-wood was yielded by it; but Loureiro, speaking of *E. cochin-chinensis*, remarks, "nec agallochum, quamvis spurium, in illa inveneri." The wood is white, soft, and spongy, and has no aromatic properties. All parts of the tree abound in an acrid milky juice, which causes intense pain if it gets into the eyes; this juice is said to be used in Australia and New Guinea to cure ulcers, leprosy, &c. If collected it hardens into a kind of caoutchouc, a grain or two of which is used by the boatmen on the Western Coast of India as a purgative. Ainslie (ii., 438) states that a decoction of the leaves is occasionally given by Hindu doctors in epilepsy, in the quantity of a quarter of a teacupful twice daily. This decoction is also used as an application to ulcers.

Smith (*Econ. Dict.*, 5) states that in Fiji the plant is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with the green leaves; he is then placed in a small room and bound hand and foot, and a small fire is made of pieces of the wood, from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke, enduring the most agonising torture and often fainting. When thoroughly smoked, he is removed, and the slime is scraped

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from the body; he is then scarified and left to await the result, which, if the patient survives, is said to be a cure.

From the lower part of the trunk and roots of this tree a soft, light, reddish suber is obtained, which is sold by the itinerant medicine men of Western India, under the name of *Tejbul*, as an aphrodisiacal tonic. It occurs in irregular-shaped pieces about half an inch thick, and often as large as the palm of the hand, from which the epidermis has been removed by scraping and trimming. The structure is that of coarse cork, the cells being about six times the size of ordinary cork cells. This substance has a glistening appearance, and is always kept saturated with water, so that on breaking it, it appears to be full of juice. It is inodorous and tasteless.

On some parts of the Coast it is said to be used for making floats for fishing nets.

Description.—A small evergreen tree or shrub, growing along with Rhizophora and Avicennia, and sometimes called the "milky mangrove." Leaves ovate, between fleshy and coriaceous, 2 to 4 inches, entire or sinuate crenate, pale brown when dry, base acute or rounded; nerves many, very faint, subhorizontal; petiole ½ to 1 inch. Flowers fragrant, male spikes numerous, 1 to 2 inches; female racemes few, ½ to 1 inch. Bracts of male spike with one flower and several minute bractioles. Filaments much lengthened after flowering. Styles free nearly to the base. Seeds subglobose, smooth. The variations in the size of the fruit and seeds are remarkable. (*Fl. Br. Ind.*)

Plants of minor importance belonging to this order, which are used medicinally, are:—

Macaranga Roxburghii, *Wight Ic.*, *t.* 817, a small tree of the Deccan Peninsula, with peltate, cordate leaves, small green flowers, and fruit the size of a pea. The young shoots and fruit are covered with a clammy, reddish secretion having an odour like turpentine. The country people use the following in *Jarandi* (*Angl.*, Liver):—One part of the young shoots, with 3 parts of the young shoots of Khoréti (*Ficus asperrima*), are

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sprinkled with hot water and the juice extracted; in this is rubbed down 2 parts each of the barks of both trees. The preparation may be administered twice a day in doses of ⅛ of a seer. The Marathi name is Chándvar. The bark contains 18·4 per cent. of tannic acid, giving a blue-black precipitate with ferric chloride, and the air-dried bark leaves 11 per cent. of mineral matter on incineration.

Chrozophora plicata, *A. Juss., Burm. Ind., t.* 62, *f.* 1, is a common weed on cultivated ground, and in the bottoms of dried up tanks in many parts of tropical India in the cold season. It is reputed to have alterative properties, and is mentioned by Ainslie as a plant which Dr. F. Hamilton had brought to him in Behar, as one of those which was supposed to have virtues in leprous affections; the dry plant is made into a decoction to which is added a little mustard. (*Mat. Ind.*, ii., 398.)

Sebastiania Chamælea, *Müll-Arg., the Cadi-avànacu* of Rheede (ii., 34), and the Bhui-erandi of the Concan, is a small plant, with linear, finely serrated leaves and small spinous cocci, the juice of which in wine is used as an astringent; a *ghrita* of the plant is considered to be tonic, and is applied to the head in vertigo.

URTICACEÆ.

GIRONNIERA RETICULATA, *Thwaites.*

Fig.—*Bedd. Fl. Sylv., t.* 313. Syn., *Celtis reticulata.*

Hab.—Sikkim, Himalaya, Assam, Burma, Pegu, Deccan Peninsula, Ceylon. The wood.

Vernacular.—Koditáni (*Tam.*), Kho-manig (*Nilgiri*), Nárakiya-ood (*Ind. Bazars*).

History, Uses, &c.—This wood does not appear to be mentioned by Indian medical writers, nor can we find any record of its collection in India for medicinal use, the bazars being supplied from Ceylon, where it has probably been in use from a remote period.

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Thunberg says :—"The tree is called by the Dutch *Strunt-hout,* and by the Cingalese *Urenne,* on account of its disgusting odour, which resides especially in the thick stem and the larger branches. The smell of it so perfectly resembles that of human ordure, that one cannot perceive the smallest difference between them. When the tree is rasped, and the raspings are sprinkled with water, the stench is quite intolerable. It is nevertheless taken internally by the Cingalese as an efficacious remedy. When scraped fine and mixed with lemon juice, it is taken internally, as a purifier of the blood in itch and other cutaneous eruptions, the body being at the same time anointed with it externally." (*Thunberg's Travels,* iv., 234.)

Thunberg obtained leaves and young plants of the tree, but no blossoms; the plants were all killed by cold in the English Channel.

The Portuguese call the wood *Pao de merda* or *Pao sujo.* In India it is burnt as a fumigatory to drive away evil spirits; the bazar name signifies "hellish incense." In Ceylon, according to Mr. J. Alexander, it is hung up near dwelling-houses as a charm to keep away evil spirits. As sold in the bazars it is a light-brown wood in irregular-shaped pieces, having a penetrating odour, exactly similar to that of fresh human ordure.

Chemical composition.—The wood has been examined by Prof. W. R. Dunstan. By distillation with water a minute quantity of a solid crystalline substance was obtained. It possessed a fæcal odour, and after purification melted at 93·5°C. Its physical and chemical properties were not those of α-naphthylamine. It afforded a crystalline picrate, by the analysis of which the substance was shown to possess the composition of methyl-indole (C^9H^9N), and by its physical and chemical properties it was proved to be identical with the Pr. 3 methyl-indole, or skatole, which Brieger isolated in 1877 from human fæces, and Salkowski soon afterwards obtained from among the putrefaction products of animal proteid. Nenchi has observed the formation of the same substance when potash is fused with albumen, and it has also been prepared synthetically. Skatole

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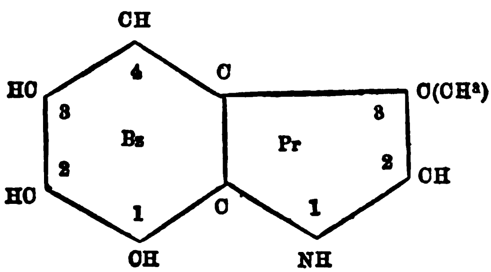
from *G. reticulata* corresponds in all its properties with synthetical skatole from propylidene phenyl-hydrazide. The occurrence of skatole in a plant has not hitherto been observed; it has appeared to be a characteristic product of the bacterial resolution of animal proteid. (*Pharm. Journ.*, June 15th, 1889.)

The nomenclature followed is that which has been proposed by Emil Fischer. The benzene nucleus of indole being designated by *Bz*, and the pyrrole nucleus by the contraction *Pr*, the nitrogen of the pyrrole nucleus is numbered 1, as well as the corresponding carbon atom of the benzene nucleus; thus the formula of skatole is—



Holoptelea integrifolia, *Planch.*, *Wight Ic.*, *t.* 1968; *Roxb. Cor. Pl.*, *t.* 78; *Bedd. Fl. Sylv.*, *t.* 310, a tree extending from the Lower Himalayas to Travancore, has a mucilaginous bark, which is boiled and the juice squeezed out and applied to rheumatic swellings; the exhausted bark is then powdered and applied over the parts covered by the sticky juice. The vernacular names of the tree are Papri (*Hind.*), Aya (*Tam.*), Navili (*Tel.*), Vavala (*Mar.*), Rasbija (*Can.*)

CANNABIS SATIVA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 231; *Reichb. Ic. Fl. Germ.*, *t.* 655; *Rheede, Hort. Mal. x.*, *tt.* 60, 61. Hemp (*Eng.*), Chanvre (*Fr.*).

Hab.—N.-W. Himalaya. Cultivated in India. The leaves, female flowering tops, resinous exudation, and seeds.

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Vernacular.—The leaves—Bhang, Sabji (*Hind., Beng., Mar.*), Ganja-ilai, Bangi-ilai (*Tam.*), Ganja-aku, Bangi-aku (*Tel.*), Kancháva-ela (*Mal.*), Bangi (*Can.*), Bháng (*Guz.*). Flowering tops—Gánja (*Hind., Beng., Guz.*), Ganja (*Tam., Tel., Mar.*), Kancha (*Mal.*), Bangi (*Can.*). The resin—Charas (*Hind., Beng., Guz., Mar.*), Ganja-pál (*Tam.*), Ganja-rasam (*Tel.*), Kanchava-pála (*Mal.*), Bangi-gondu (*Can.*). The seeds—Gánje-ke-bij (*Hind.*), Ganja-virai (*Tam.*), Ganja-vittulu(*Tel.*), Kanchava-vitta (*Mal.*), Bangi-bija (*Can.*), Ganja-bij (*Beng.*), Bhanga-cha-bi (*Mar.*), Bháng-nu-bi (*Guz.*).

History, Uses, &c.—The hemp plant, in Sanskrit Bhanga and Indrasana, "Indra's hemp," has been known in the East as a fibre plant from prehistoric times. It is mentioned along with the Vedic plant Janjida, which has magic and medicinal properties, and which is described in the Athavaveda (ix., 34, 35) as a protector, and is supplicated to protect all animals and properties. The gods are said to have three times created this herb (oshadhi). Indra has given it a thousand eyes, and conferred on it the property of driving away all diseases and kiillng all monsters; it is praised as the best of remedies, and is worn as a precious talisman; along with hemp it prevents wandering (vishkandha), fever and the evil eye. De Gubernatis says that in Sicily the peasant women still believe in hemp as an infallible means of attaching their sweethearts. On Good Friday they take a thread of hemp and twenty-five needlefuls of coloured silk, and at midnight weave them together, repeating the following lines:—

Chistu è cánnavu di Christu
Servi pi attaccari a chistu.

"This is the hemp of Christ; it serves to attach this man." They then enter the Church with the thread in their hands, and at the moment of the consecration of the host, they make three knots in it, adding at the same time some hairs of the man they are in love with, and invoke all the demons to attract him to his sweetheart. (*Cf.* Mattia 'di Martino, *Usi e credenze popolari Siciliane*, Woto, 1874.) Burns in "Halloween" notices a

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closely-allied superstition. The intoxicating properties which the plant possesses in its Eastern home appear not to have been discovered until a more recent date, but in the fifth chapter of Menu, Brahmins are prohibited from using it, and in the sacred books of the Parsis the use of *Bana* for the purpose of procuring abortion is forbidden. In Hindu mythology the hemp plant is said to have sprung from the *amrita* produced whilst the gods were churning the ocean with Mount Mandara. It is called in Sanskrit Vijaya, "giving success," and the favourite drink of Indra is said to be prepared from it. On festive occasions, in most parts of India, large quantities are consumed by almost all classes of Hindus. The Brahmins sell Sherbet* prepared with *Bhang* at the temples, and religious mendicants collect together and smoke *Ganja*. Shops for the sale of preparations of hemp are to be found in every town, and are much resorted to by the idle and vicious. Hemp is also used medicinally; in the *Rája Nirghanta* its synonyms are Urjaya and Jaya, names which mean promoter of success, Chápala "the cause of a reeling gait," Ananda "the laughter moving," Harshini "the exciter of sexual desire"; among other synonyms are Kashmiri "coming from Kashmir," Matúláni "the maternal uncle's wife," Mohini "fascinating," &c. Its effects on man are described as excitant, heating, astringent; it destroys phlegm, expels flatulence, induces costiveness, sharpens the memory, excites appetite, &c. Susruta recommends the use of Bhang to people suffering from catarrh. In the *Rájavalabha*, a recent work in use in Bengal, we are informed that the gods through compassion on the human race sent hemp, so that mankind by using it might attain delight, lose fear, and have sexual desires.

The seductive influences of hemp have led to the most extravagant praise of the drug in the popular languages of India, but in truth it is one of the curses of the country; if its use is persisted in, it leads to indigestion, wasting of the body, cough, melancholy, impotence and dropsy. After a time its votary

* *Sabzi* or *Sabji*, an infusion of *Bhang* with black pepper, anise and sugar. In Bengal milk, and cucumber and melon seeds are added.

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becomes an outcaste from society, and his career terminates in crime, insanity, or idiotcy.

> *Ganja pie gur-gyan ghate, aur ghate tan andar ka,*
> *Khokat, khokat dam nikse, mukh dekho jaisa bandar ka.*
>
> Who ganja smoke do knowledge lack, the heart burns constantly,
> The breath with coughing goes, the face as monkey's pale you see.
>
> *Fallon.*

According to tradition, the use of hemp as an intoxicant was first made known in Persia by Birarslan, an Indian pilgrim, in the reign of Khusru the first (A.D. 531—579), but, as we have already stated, its injurious properties appear to have been known long before that date.

There can be no doubt that the use of hemp as an intoxicant was encouraged by the Ismailians in the 8th century, as its effects tended to assist their followers in realising the tenets of the sect:—

> بنکی زدیم سر اناالحق شد آشکار
> مارا باین کیاه ضعیف این کمان نبود
>
> We've quaffed the emerald cup, the mystery we know,
> Who'd dream so weak a plant such mighty power could show!

Hasan Sabáh, their celebrated chief, in the 11th century notoriously made use of it to urge them on to the commission of deeds of daring and violence so that they became known as the Hashsháshin or "Assassins." Hasan studied the tenets of his sect in retirement at Nishapur, doubtless at the monastery noticed by O'Shaughnessy (*Bengal Dispensatory*), in the following terms:— "Haidar lived in rigid privation on a mountain between Nishapur and Rama, where he established a monastery; after having lived ten years in this retreat, he one day returned from a stroll in the neighbourhood with an air of joy and gaiety; on being questioned, he stated that, struck by the appearance of a plant, he had gathered and eaten its leaves. He then led his companions to the spot, who all ate and were similarly excited. A tincture of the hemp leaf in wine or spirit seems to have been the favourite formula in which Sheikh Haidar indulged himself. An Arab poet sings of Haidar's emerald cup, an evident

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allusion to the rich green colour of the tincture. The Sheik survived the discovery ten years, and subsisted chiefly on this herb, and on his death his disciples at his desire planted it in an arbour round his tomb. From this saintly sepulchre the knowledge of the effects of hemp is stated to have spread into Khorasán. In Chaldea it was unknown until 728 A. H., the kings of Ormus and Bahrein then introduced it into Chaldea, Syria, Egypt and Turkey."

Taki-ed-din Ahmad, commonly known as Makrizi, who wrote a number of treatises upon Egypt in the 14th century, mentions the lease of the monopoly for the sale of Hashish in that country, and its abolition in (1286) by the Sultan.

Haji Zein in the Ikhtiárát (1368), after noticing the two kinds of Kinnab mentioned by the Greeks, states that Indian hemp is known as *Bang* or *Sabz* in Shiraz; after describing its properties, he says that in cases of poisoning by it vomiting should be induced by the administration of butter and hot water to empty the stomach, and that afterwards acid drinks should be administered.

The Greeks were acquainted with hemp more than 2000 years ago; Herodotus (iv., 74, 75) mentions it as being cultivated by the Scythians, who used its fibre for making their garments, and the seeds to medicate vapour baths. Dioscorides mentions two kinds of καννάβις, the wild and the cultivated; the former is the *Althæa cannabina* of Linneus, and the latter *Cannabis sativa;* he states that the seeds, if eaten too freely, destroy the virile powers, and that the juice is used to relieve earache. Galen and the early Arabian physicians, such as Ibn Sina and Rázi, follow Dioscorides in his opinion of the properties of hemp, and do not notice its having any intoxicating properties, and unless the *Gelotophyllis* of Pliny (24, 102) was Indian hemp, there is no evidence to show that the ancients were acquainted with them. Pliny says:—"The Gelotophyllis (laughing leaf) is a plant found in Bactriana, and on the banks of the Borysthenes. Taken internally with myrrh and wine, all sorts of visionary forms present themselves, and excite the

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most immoderate laughter, which can only be put an end to by taking kernels of the pine nut, with pepper and honey, in palm wine." The earliest Western medical writer who distinctly mentions the intoxicating properties of hemp is Ibn Baitar, a native of Africa, who died in Damascus in 1248. All the later Mahometan physicians describe the two kinds of Kinnab mentioned by the ancients, whom they quote, and a third kind called *Hindi* or Indian. The name Cannabis is derived from the Persian Kanab. which is connate to the Sanskrit S'ana, the Russian Kanopla, the Irish Canaib, the Iceland Haup, the Saxon Hænep, and the old German Hanaf.

The author of the *Makhzan-el-Adwiya* gives Udifarúnas* as the Yunáni name, and Kanabira as the Syrian, and also mentions a number of cant terms which are applied to it, such as Wark-el-khyál, Hashish, Hashishat-el-fukará, Arsh-numá, Chatr-i-akhzar, &c. *Charas* is described, and the practice of smoking it. The Bengal-grown hemp is said to be less intoxicating than that grown in more Northern climates. Hempseed is called in Persian Shahdánah, "royal seeds." The leaves are made into Sherbet and conserves for intoxicating purposes. The properties of hemp are described as cold and dry in the third degree, that is, stimulant and sedative, imparting at first a gentle reviving heat, and then a refrigerant effect, the drug at first exhilarates, improves the complexion, excites the imagination, increases the appetite, and acts as an aphrodisiac; afterwards its sedative effects are observed—if its use is persisted in, it leads to indigestion, wasting of the body, melancholy, impotence and dropsy.

Mirza Abdul Razzak considers hemp to be a powerful exciter of the flow of bile, and relates cases of its efficacy in restoring appetite, of its utility as an external application as a poultice with milk in relieving hæmorrhoids, and internally in gonorrhœa, to the extent of a quarter drachm of bhang.

Charas is only mentioned in comparatively recent medical works. The word is said to be derived from the Sanskrit चर्म

* Some such word may have been manufactured by the Syrian monks in the Middle Ages, possibly from εὖ and διαφέρω as an equivalent to the Sanskrit 'Vijaya.'

a skin, but it occurs in Persian with the primary signification of a piece of leather or cloth, the four corners of which are tied up so as to form a wallet, such as beggars carry; in Hindi it signifies a leather bag for holding water, &c. The Charas collected in Central Asia is stored in leathern bags by the cultivators. Among European writers in the East, Rheede and Rumphius figure and describe the Indian plant; the latter states that the kind of mental excitement it produces depends upon the temperament of the consumer. He quotes a passage from Galen, lib. I. (*de aliment. facult.*), in which it is asserted that in that great writer's time it was customary to give hempseed to the guests at banquets, as a promoter of hilarity and enjoyment (the seeds are still roasted and eaten in the East). Rumphius adds, that the Mahometans in his neighbourhood frequently sought for the male plant from his garden, to be given to persons afflicted with virulent gonorrhœa or with asthma, and the affection which is popularly called "stitches in the side." He tells us, moreover, that the powdered leaves check diarrhœa, are stomachic, cure the malady named *Pitao*, and moderate excessive secretion of bile. He mentions the use of hemp smoke as an enema in strangulated hernia, and of the leaves as an antidote to poisoning by orpiment.

In the *Bulletin de Pharmacie* (1810, p. 400), we find it briefly described by M. Rouyer, apothecary to Napoleon, and member of the Egyptian Scientific Commission, in a paper on the popular remedies of Egypt. With the leaves and tops, he tells us, collected before ripening, the Egyptians prepare a conserve, which serves as the base of the *berch*, the *diasmouk*, and the *bernaouy*. Hemp leaves reduced to powder and incorporated with honey, or stirred with water, constitute the *berch* of the poor classes.

Ainslie notices *Májún*, a confection made with hemp leaves to be used as a sweetmeat, the composition of which varies in different parts of the East, and to which are often added other intoxicating drugs. O'Shaughnessy in the *Bengal Dispensatory* 1842 gives a detailed account of its preparation in Calcutta.

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The medicinal properties of Cannabis have now been investigated by many European physicians in India. O'Shaughnessy tried it with more or less success in various diseases, especially in tetanus, hydrophobia, rheumatism, the convulsions of children and cholera. Subsequent experience has confirmed the value of the drug as a remedy in tetanus and cholera. In the former disease we have obtained most satisfactory results, large doses are required, and the patient must be kept under the influence of the drug for some days.

In cholera its action may be compared with that of opium; it is most likely to be successful when resorted to early in the disease. People suffering from painful chronic diseases, such as rheumatism, are completely relieved of their pains by hemp, but as the effects of the drug go off, the pains return; some of O'Shaughnessy's patients became cataleptic whilst under its influence. Christison, speaking of Indian Hemp, says:—"I have long been convinced, and new experience confirms the conviction, that for energy, certainty, and convenience, it is the next anodyne, hypnotic and antispasmodic, to opium and its derivatives, and often equal to it."

Among the "*special opinions*" collected by Dr. Watt for the *Dict. of the Econ. Prod. of India*, we observe that Dr. S. J. Rennie recommends the tincture in doses of from 15 to 20 minims three times a day in acute dysentery, and states that he, as well as other medical officers, obtained excellent results with it. Dr. J. E. T. Aitchison states that the oil of the seeds, known as *Kandir yak* in Turkistan, is used in Kashmir as a liniment for rheumatic pains. Others notice it as having valuable narcotic, diuretic and cholagogue properties. (*Op. cit.*, vol. ii., p. 124.)

A. Aaronson states in the *British Journal of Dental Science*, that the tincture as a local anæsthetic is perfectly satisfactory. He has extracted with its aid as many as twenty-two teeth and stumps at one sitting. His plan is to dilute the tincture some three or five times, according to the probable duration of the operation. The diluted tincture is then applied on cotton

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wool to cavities, if such exist, and also about the gums of the affected teeth. The beaks of the extracting forceps are also, after being warmed, dipped in the tincture. In cold weather it is best to dilute the tincture with warm water. His patients acknowledge the immunity from pain they enjoyed during the operations, and all expressed surprise and pleasure at the simplicity of the performance.

Tannate of cannabin has recently been recommended as a hypnotic. Cannabis appears capable, directly or indirectly, of causing uterine contraction, as in many cases of uterine hæmorrhage; and it is also said to provoke this act during labour with as much energy as ergot, but with less persistant action.

A recent correspondence in the *Lancet*, anent the variation in action and occasional toxic effects of this drug, has brought from Dr. J. Russell Reynolds an important contribution respecting its clinical value.

In explaining the occasional toxic effects of this drug, Dr. Reynolds says two things must be remembered: first, that, by its nature and the forms of its administration, cannabis indica is subject to great variations in strength. Extracts and tinctures cannot be made uniform, because the hemp grown at different seasons and in different places varies in the amount of the active therapeutic principle. It should always be obtained from the same source, and the minimum dose should be given at first, and gradually and cautiously increased. The second important fact to keep in view is, that individuals differ widely in their relations to various medicines and articles of diet—perhaps to none more than to substances of vegetable origin, such as tea, coffee, ipecacuanha, digitalis, nux vomica, and the like. In addition to the purity of the drug, the possibility of idiosyncrasy must be borne in mind as calling for caution in giving Indian hemp. By gradually increasing the dose and habituating the organism to its use, the use of cannabis indica may be pushed to 3 or 4 grains of the extract at a dose with positive advantage. But in Dr. Reynolds' experience 1 grain would

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bring about toxic effects in the majority of healthy adults; and ¼ of a grain has done the same, but never ⅕, which is the proper amount with which to begin the use of the drug among grown persons, $\frac{1}{10}$ of a grain being the proper initial dose for children. The best preparation for administration is the tincture—1 grain to 20 or 10 minims—dropped on sugar or bread. The minimum dose should be given, as before stated, repeated every four or six hours and gradually increased every third or fourth day, until either relief is obtained or the drug is proved useless. With such precautions, Dr. Reynolds states he has never met with toxic effects, and rarely failed to ascertain in a short space of time the value or uselessness of the drug.

Its most important results are to be found in the mental sphere; as, for instance, in Senile Insomnia, with wandering. An elderly person (perhaps with brain softening), is fidgety at night, goes to bed, gets up, thinks he has some appointment to keep, that he must dress and go out. Day, with its stimuli and real occupations, finds him quite rational again. Nothing can compare in utility to a moderate dose of Indian hemp at bedtime—¼ to ⅓ of a grain of the extract. In alcoholic subjects it is uncertain and rarely useful. In Melancholia it is sometimes serviceable in converting depression into exaltation; but unless the case has merged into senile degeneration, Dr. Reynolds does not now employ cannabis indica. It is worse than useless in any form of mania. In the occasional night restlessness of general paretics and of sufferers from the "temper disease" of Marshall Hall, whether children or adults, it has proved eminently useful.

In painful affections, such as Neuralgia, Neuritis, and Migraine, Dr. Reynolds considers hemp by far the most useful of drugs, even when the disease is of years' duration. In neuritis the remedy is useful only in conjunction with other treatment, and is a most valuable adjunct to mercury, iodine, or other drugs, as it is in neuralgia when given with arsenic, quinine, or iron, if either is required. Many victims of diabo-

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lical migraine have for years kept their sufferings in abeyance by taking hemp at the threatening or onset of the attack. In sciatica, myodynia, gastrodynia, enteralgia, tinnitus aurium, muscæ volitantes, and every kind of so-called hysterical pain, cannabis indica is without value. On the other hand, it relieves the lightning pains of Ataxia, and also the multiform miseries of the gouty, such as tingling, formication, numbness, and other paræsthesiæ.

In clonic spasm, whether epileptoid or choreic, hemp is of great service. In the Eclampsia of children or adults, from worms, teething (the first, second, or third dentition), it gives relief by itself in many cases. Many cases of so-called Epilepsy in adults—epileptoid convulsions, due often to gross organic nerve-centre lesions—are greatly helped by cannabis indica, when they are not affected by the bromides or other drugs. Take, for instance, violent convulsions in an overfed man, who is attacked during sleep a few hours after a hearty supper, the attacks recurring two or three times an hour for a day or two, in spite of "clearing the primæ viæ," or using bromine or some other classic drug. These attacks may be stopped at once with a full dose of hemp. In brain tumours or other maladies in the course of which epileptoid seizures occur, followed by coma, the coma being followed by delirium,—first quiet, then violent—the delirium time after time passing into convulsions, and the whole gamut being repeated, Indian hemp will at once cut short such abnormal activities, even when all other treatment has failed. In genuine epilepsy it is of no avail. In cases where it has seemed to do good, the author doubts the correctness of the diagnosis, and suspects organic lesion or eccentric irritation. In tonic spasms, such as torticollis and writers' cramp, in general chorea, in paralysis agitans, in trismus, tetanus, and the jerky movements of spinal sclerosis, cannabis indica has proved absolutely useless. At the same time, it is most valuable in the Nocturnal Cramps of gouty or old persons, in some cases of Spasmodic Asthma, and in simple Spasmodic Dysmenorrhœa. Thus it will be perceived that for the relief of suffering, quite apart from a curative effect, hemp must ever

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be held in high esteem, and ranked with the poppy and with mandragora. (*Medical Annual*, 1891.)

Physiological action.—Like some other narcotics, Indian hemp, when given by the stomach to carnivorous animals, produces its characteristic effects, but graminivorous animals and fish exhibit only vacillating movements and a dull aspect. Upon man its action varies with the individual's temperament and tendencies. Some it inspires with pugnacity, others it inclines to dreamy contemplation, to motiveless merriment, or to maudlin sensibility; some it makes unnaturally active and restless, and plunges others in a drowsy stupor; but more than any other agent, not even excepting belladonna, it perverts the natural perception of objects and their normal condition and relations. Time, distance, and sound are especially apt to form the subjects of the hallucinations caused by this drug. As in dreams, the events of days or weeks may be compressed into an actual period of a few minutes, objects near at hand may seem to form a limitless perspective, and whispered tones may have the reverberation of thunder. These and an infinite variety of fantastic pictures are evoked by smoking the drug, as it is generally employed in Asia, associated with opium. During its influence the physical condition of the experimenter exhibits changes in acceleration of the pulse, warmth of skin, restless muscular movements, more or less insensibility to touch and pain, and sometimes impaired power of locomotion, the limbs feeling as if weighted with lead. In one reported case a diffused vesicular eruption was attributed to this medicine. (*Hyde.*) It does not increase, but, on the contrary, impairs, the venereal propensity and power. The habitual use of cannabis in excessive doses causes the face to become bloated, the eyes injected, and the limbs weak and tremulous; the mind grows imbecile, and ultimately death by marasmus is apt to occur. Acute poisoning by large doses is marked by various and dissimilar symptoms in different cases. In some there is loss of consciousness, with collapse or stupor, insensible pupils, a pale, clammy, and insensible skin, extreme debility, and a small, feeble pulse. In others a cataleptic condition, spasms, or convulsions occur, and in all there is

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marked anæsthesia. The last-named effect led to the use of cannabis by the Chinese in certain surgical operations. (*Stillé and Maisch.*)

Collection.—The flowering tops of the female plant are collected, and, after having been allowed to wither in the open air for about 48 hours, are arranged on a mat so as to form a circle, and are trodden upon by a number of men, linked together by resting their arms across each other's shoulders, who walk round and round; the object being to compress the resinous flower tops into a compact mass. This process is repeated several times after shifting and re-arranging the *Gánja.* In Bengal a round kind of *Gánja* is prepared by rolling the flowering tops under the feet, and afterwards between the palms of the hands. During the manufacture of *Gánja* a quantity of powder separates, which is known as *Chúr* or *Rora;* it is collected, mixed with an extract of the plant, and made into round balls about the size of a musket ball, which are used for smoking like *Charas.* A similar preparation is made from the dust of the leaves; it is popularly known as *Charas;* several varieties of it are found in the bazars. True *Charas* is collected in Central Asia by shaking, rubbing, or beating the resinous exudation from the flowering plant; it separates as a greyish powder, which, after being packed in bags, gradually consolidates into an oily resinous mass. The genuine article is rarely to be met with in commerce, that sold in the bazars being largely adulterated by the middlemen in the Punjab with the leaves and dust of *Bhang.* *Bhang* is made by collecting the leaves and drying them. All of these drugs are obtained from the female plant, which the natives consider to be the male, because it bears the seed; all male plants are carefully extirpated by the *hemp doctor*, a person whose business it is to prune the plants so as to produce the maximum amount of flowering heads.

Description.—*Bhang* consists of the dried leaves, which are of a deep green colour and usually broken, so as to form a coarse powder; the odour is peculiar. The leaves have long

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petioles and are digitate, with linear-lanceolate, sharply serrated leaflets, tapering to a long smooth point.

Gánja is the name given to the flowering tops of the female plant. The flowers form erect clustered spikes, often 6 to 8 inches long; in the drug, the spikes are compressed, flat or round, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour.

Pure *Charas* is a greenish-brown, moist, resinous mass, having the peculiar odour of the plant, and consists of resin mixed with the hairs and fragments of the leaf. Bazar *Charas* varies much in quality, some specimens being only very partially soluble in spirit, friable, and of an earthy appearance. Sixty grains of the finest Yarkand *Charas* which we examined left, after exhaustion with spirit, only 13 grains of residue, chiefly hairs of the plant.

Chemical composition.—The most interesting constituents of hemp, from a medical point of view, are the resin and the volatile oil. The former was first obtained in a state of comparative purity by T. and H. Smith in 1846. (*Pharm. Journ.*, vol. vi., p. 171.) It is a brown, amorphous solid, burning with a bright white flame, and leaving no ash. It has a very potent action when taken internally, two-thirds of a grain acting as a powerful narcotic, and one grain producing complete intoxication.

When water is repeatedly distilled from considerable quantities of hemp, fresh lots of the latter being used for each operation, a volatile oil lighter than water is obtained, together with ammonia. This oil, according to the observations of Personne (1857) (*Journ. de Pharm.*, vol. 39, p. 48), is amber-coloured, and has an oppressive hemp-like smell. It sometimes deposits an abundance of small crystals. With due precautions it may be separated into two bodies, the one of which named by Personne *Cannabene*, is liquid and colourless, with the formula $C^{18}H^{20}$, the other, which is called *Hydride of Cannabene*, is a solid, separating from alcohol in platy crystals, to which Personne assigns the formula $C^{18}H^{22}$. He asserts that cannabene has indubitably a physiological action, and even claims it as the

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sole active principle of hemp. Its vapour he states to produce, when breathed, a singular sensation of shuddering, a desire of locomotion, followed by prostration and sometimes by syncope. Bohling, in 1840, observed similar effects from the oil, which he obtained from the fresh herb just after flowering, to the extent of 0·3 per cent.

As to the resin of Indian hemp, Bolas and Francis, in treating it with nitric acid, converted it into *Oxycannabin*, $C^{20}H^{20}N^2O^7$. This interesting substance may, they say, be obtained in large prisms from a solution in methylic alcohol. It melts at 176° C., and then evaporates without decomposition; it is neutral. (*Pharmacographia.*)

Preobraschensky (*Pharm. Zeitsch. f. Russland*, 1876, p. 705) made a chemical examination of a quantity of *haschisch*, which he brought with him from China, and was enabled, according to his own statement, to separate from it a volatile alkaloid, which he held to be identical with nicotine, and which he believed to be the active principle of cannabis. This, in view of the distinctive and very different action of cannabis, was somewhat remarkable. It is highly probable, as has been suggested by Dragendorff and Marquiss (*Pharm. Zeitung*, 1877), that the *haschisch* used by Preobraschensky was mixed with tobacco, which it often is in Eastern countries.

Louis Siebold and Bradbury reported to the British Pharmaceutical Conference (1881) that, after an elaborate investigation, they had arrived at the conclusion of Dragendorff and Marquiss, and that in the course of their investigation they made the interesting discovery that pure cannabis does actually contain a volatile alkaloid, which does not, however, possess the characters of nicotine. They separated it in very small quantity, obtaining not more than 2 grains from 10 lbs. of Indian hemp. They give it the name of *Cannabinine*. They record no observations as to its physiological action; and they, therefore, leave it doubtful as to whether this volatile alkaloid is the narcotic principle of cannabis. (*Pharm. Journ.*, xii., p. 326.)

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Dr. Hay (*Pharm. Journ.*, xiii., p. 998) made a chemical examination of the drug, the results, so far, of which lead him to believe that *Cannabis indica* contains several alkaloids. He says:—"In a future communication I hope to be able to give an exact description of the distinctive characters and toxic action of each. In the meantime, I shall content myself with the description of one which I have obtained in a considerable degree of purity, and one which, rather remarkably, possesses an action similar to that of strychnia. It is evidently, therefore, quite a secondary alkaloid of the cannabis, and reminds one of the thebaine of opium. This alkaloid was obtained from a watery infusion of powdered *Cannabis indica* by treating it with a solution of subacetate of lead, and filtering. To the filtrate was added ammonia, and the precipitate removed by filtration. The filtrate, acidulated with sulphuric acid, was now treated with a solution of phospho-wolframic acid in order to precipitate the alkaloids present. The precipitate, which was fairly abundant, was, after the fluid had been removed by filtration and washing with dilute sulphuric acid and pressing, mixed with barium hydrate and water, which formed an insoluble wolframate and set free the alkaloids. The filtrate was next deprived of its excess of barium by means of a stream of carbonic acid gas and again filtered. The filtrate was at a gentle heat evaporated almost to dryness and acidulated with sulphuric acid, and treated with absolute alcohol. The sulphate of the alkaloids thus formed was partially soluble in alcohol, partly not. It was from the soluble part that the alkaloid in question was procured. The sulphate was converted into a chloride by treatment with barium hydrate, afterwards with carbonic acid to remove excess of barium, and, finally, with hydrochloric acid to neutralization. The chloride was evaporated and treated with absolute alcohol, in which it in part dissolved. From the solution, by addition of excess of carbonate of soda and frequent shaking with ether, an alkaloid was obtained in the form of colourless needle-like crystals.

"The alkaloid was easily soluble in water, soluble also in alcohol, and more slowly soluble in ether and chloroform. It

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caused tetanus in frogs in exactly the same manner as strychnia, increasing the excitability of the reflex centres of the spinal cord. It did not give a violet colour with sulphuric acid and bichromate of potash. It was, therefore, although similar in action to strychnia, not chemically identical with it. A solution of it in water was precipitated by the various alkaloidal precipitants, platinic chloride, iodide of potassium and mercury, phosphotungstate of soda, phosphomolybdic acid, phospho-wolframic acid, &c. Although I obtained the alkaloid from 1 kilo. of cannabis, yet the quantity of it was so small that it was insufficient for an elementary analysis.

"To this alkaloid I propose to give the name of *tetano-cannabine*, as indicative of its action."

The Tannate of *Cannabin* of Merck (*Pharm. Jour.*, xiii., p. 1052), a glucoside contained in Indian hemp, which he has combined with tannin, is a yellowish-brown powder, with a taste of tannin, and a rather agreeable odour; it is insoluble in water and ether, and only slightly soluble in alcohol; in alkaline solutions it dissolves readily. This substance is said to be free from any admixture of the volatile alkaloid of *Cannabis indica*, not to produce intoxication, and to be useful as a hypnotic; it is said not to derange the digestive and secretory organs like opium, and to be especially valuable in irritable states of the nervous system, but Dr. H. C. Wood has found it to be inert physiologically. Warden and Waddell of Calcutta, although operating on a large quantity of Indian hemp of ascertained activity, were unable to find any evidence of the existence of such a principle as Dr. Hay describes. They further remark that:— "As many of those addicted to the Hashish form of intemperance obtain the intoxicating effects by smoking the plant in a pipe, it is to be expected that destructive distillation of the freshly prepared resin might yield up the active principle. This process was therefore resorted to. By the destructive distillation of freshly prepared alcoholic extract of the plant to which an excess of caustic potash solution had been added, an amber-coloured oil was obtained, which, by exposure to the air or the action of alkalies,

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rapidly became of a dark reddish-brown colour. This oil had a mildly empyreumatic odour, which was distinctly tobacco-like. Its taste was warm, aromatic, and somewhat terebinthinate. The oil contained phenol, ammonia, and several other of the usual products of destructive distillation.

"The nicotine-like principle contained in this oil appeared to be an alkaloid. It formed salts which evolved a strong nicotine-like odour when acted on by alkalies. But physiologically it was found to be inert, and therefore was evidently not identical with nicotine.

"The oil as a whole was also found to be devoid of any narcotic or irritant qualities. About $\frac{1}{8}$ of an ounce was introduced into the stomach of a cat without producing any sensible effect. These results do not coincide with those of Personne, who asserted that the active principle of the plant resided in the volatile oil. It is just possible that the active principle was decomposed by the high temperature necessary for destructive distillation." (*Ind. Med. Gaz.*, Dec. 1884.)

Kennedy (*Pharm. Record,* vi., p. 304) made a search for nicotine in Indian hemp without success, but obtained indications of the presence of another alkaloid.

E. Jahns (*Archiv. d. Pharm.*, 1887) reported that he had separated from Indian hemp a base which he has identified as *choline*, and points out that this result corresponds fairly with the statement of previous workers, except in respect to the crystallizability of Dr. Hay's alkaloid and solubility in ether. The quantity of choline obtained by the author from different samples varied considerably, but amounted at the most to only $\frac{1}{10}$ per cent.

H. F. Smith (*Amer. Journ. Pharm.*, Aug. 1891), by two entirely different processes, obtained an alkaloid from Indian hemp, which separated from ethereal solutions in the form of a yellowish-green, transparent varnish-like substance. It had a strong, peculiar odour, resembling that of coniine; was soluble in ether, chloroform, alcohol, and acidulated water, but only slightly so in water; was alkaline to test paper and capable of

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neutralizing acids. When dissolved in very dilute H^2SO^4 (1 gtt. in 5 cc.), it gave a clear yellow solution and the following reactions:—

With Mayer's reagent, an abundant white precipitate.
„ $KI+I+H^2O$, an abundant brown precipitate.
„ Phosphomolybdate of soda, an abundant white precipitate.
„ Solution of picric acid, an abundant yellow precipitate.
„ „ $K^2C^2O^7$, a yellowish-brown precipitate.
„ „ NH^4OH, a yellowish-green precipitate.
„ „ NaOH, a yellowish-green precipitate.
„ „ KOH, a yellowish-green precipitate.
„ „ KI, a yellowish precipitate.
„ „ tannic acid, a yellowish-brown precipitate.

Supposing this alkaloid of Indian hemp to be highly poisonous, it is present in so small a quantity as to be of little if any importance therapeutically.

Toxicology.—Lyon says—"In India, Cannabis appears to be seldom, if ever, used for homicidal purposes. Fatal, accidental or suicidal cases have, however, been reported. Cases have also been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. Thus Chevers mentions a case which occurred at Ahmednagar, in which a woman, having first drugged with *majun*, a child aged seven, afterwards murdered him for the sake of his ornaments. (*Med. Jurisp.*, p. 225.) Harvey reports a case in which *charas* appears to have been used by a road-poisoner at Amritsar, in order to facilitate theft. (*Beng. Med. Leg. Rep.*, 1870-72, p. 268.) A case is also reported by Dr. Cullen of Hoshangabad, in which *majun* was given to a woman and her daughter, "not with the intention of causing death, but to effect a criminal purpose." In these two females, the symptoms present exactly resembled those of dhatura-poisoning, and it would appear that dhatura is sometimes used as an ingredient of *majun*. (*Lyon, Med. Jurisp.*, p. 260.) Ganja is frequently used as a poison in Southern India, chiefly administered with criminal intent. In

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a case of dacoity investigated near Madura in 1886, it was found that *ganja* had been given in food served up to some travellers. It is resorted to by the relatives of converts to Christianity in Travancore, to prevent them changing their religion or to punish them for doing so.

Dr. Hové, a Polish *savant*, who was sent out to Bombay by the British Government in 1787-89, speaking of Cannabis, says (p. 141): "I arrived at Mithampoor and waited on the Rajah, who ordered provisions for my people and guards. He also ordered to each person a basinful of a beverage which is called by the inhabitants *Beng*. This is nothing else but a decoction of seeds, and bruised leaves and stalks of the Cannabis, which has, however, such powerful quality, that even the steam where it was served overpowered me in a few minutes, so that I was under the necessity of leaving the room." We have no doubt that Cannabis is much more frequently used in India for drugging people than is generally known.

Commerce.—The sea-borne trade in preparations of hemp is insignificant; a small quantity of *ganja* goes to Europe for medicinal use. The imports by trans-frontier routes do not exceed 2½ lakhs of rupees yearly, and the exports 20 to 25 thousand rupees. As regards internal trade, the total annual revenue transactions (transfers, &c.) amount to about 15 lakhs of rupees. The wholesale cost of *ganja* duty-free is about 4½ annas per lb., and of *bhang* Rs. 8 per cwt. The revenue realised by the Indian Government by the duty on hemp is about 30 lakhs of rupees yearly. For full particulars of the Hemp trade in India, see *Dict. Econ. Prod. of India*, ii., p. 113.

FICUS RELIGIOSA, *Linn.*

Fig.—*King, Fic.* 55, *t.* 67 A, 84u; *Wight Ic.*, *t.* 1967; *Rheede, Hort. Mal.* i., *t.* 27.

Hab.—India. The root-bark.

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FICUS BENGALENSIS, *Linn.*

Fig.—*King, Fic.* 18, *t.* 31, 81c; *Wight Ic.*, *t.* 1989; *Rheede, Hort. Mal. i.*, *t.* 28.

Hab.—India. The root-bark.

FICUS TJAKELA, *Burm.*

Fig.—*King, Fic.* 57, *t.* 70, 84x; *Rheede, Hort. Mal. iii.*, *t.* 64.
Hab.—India. The root-bark.

FICUS GLOMERATA, *Roxb.*

Fig.—*Roxb. Cor. Pl. ii.*, *t.* 123; *Wight Ic.*, *t.* 667.

Hab.—India. The root-bark, fruit, juice, and galls.

Vernacular.—*F. religiosa*, Pipal, Pipar (*Hind.*, *Mar.*, *Guz.*), Aswat, Asud (*Beng.*), Arasa (*Tam.*), Rai, Raiga (*Tel.*), Rangi, Basri (*Can.*). *F. bengalensis*, Bar, Bargat (*Hind.*, *Beng.*, *Guz.*), Vara, Vari (*Mar.*), Ala (*Tam.*), Mari, Peddi-mari (*Tel.*), Aladamara (*Can.*). *F. Tjakela*, Ram-anjir, Pákhar (*Hind.*, *Beng.*), Bassári, Pakri, Lendva (*Mar.*), Jovi (*Tam.*), Jevi (*Tel.*), Kari, Bassári (*Can.*) *F. glomerata*, Gúlar, Umar (*Hind.*), Jagnodumar (*Beng.*), Atti (*Tam.*), Moydi, Atti (*Tel.*), Kulla-kith (*Can.*), Umbara (*Mar.*), Umbro (*Guz.*).

History, Uses, &c.—In the *Káthaka Upanishad* an eternal and cosmogonic Ásvattha or Pippal tree is described; this tree is said to have its roots above and branches below (úrdhvamúlo' vákśakha esho' śvatthah sanátanah); it bears the names of 'seed,' 'brahman,' 'amrita'; the worlds rest upon it; beneath it there is nothing. The wood of the Ásvattha when rubbed against that of the Sami (*Acacia Suma*) engenders fire, which is symbolic of reproduction, the former representing the male and the latter the female energy. At the marriage ceremony of the Hindus, both of these plants are necessary. To this mythic tree which represented the macrocosm, wonderful medicinal properties are ascribed in the Atharvaveda; the medicine chest of the Vedic physician, and the cup to contain

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the Soma, are to be made of it; its branches are the Vedas. In the *Válakhilya*, a collection of apocryphal hymns in the *Rig-veda*, the marriage of the actual tree with Tulasi is enjoined; it is worshipped on Saturdays in the month of Sravan and on Somvatis or "lunar days." Women perform Pradakshina, "walking round it from left to right," to secure the survival of their husbands and good luck generally, as Savitri, the wife of Satyavan, is said to have recovered her deceased husband by its worship. The thread ceremony and marriage of the tree with the Durva (*Cynodon Dactylon*) is also performed by women. Sacrificial spoons are still made from its wood. *F. religiosa* is the *Budhidru*, or tree of wisdom, of the Jains and Buddhists, who relate that at the birth of the Buddha an enormous Aśvattha sprung from the centre of the universe, an offshoot, no doubt, of the Vedic and cosmogonic tree. In the *Rája Nirghantu* it bears the synonyms of Yájnika "sacrificial," Srimana "fortunate," Vipra "wise," Sevya "worthy of worship," &c. Its root-bark, together with that of the three other species of *Ficus* placed at the head of this article, and the root-bark of the Neem, form the *Panchavalkala* or "five barks," and a decoction of them (pancha-valkala kasháya) is much used as a gargle in salivation, as a wash for ulcers, and as an astringent injection in leucorrhœa. The powdered root-bark of the Aśvattha, rubbed with honey, is applied to apthæ and unhealthy ulcers to promote granulation.

F. bengalensis, the Vata or Nyagrodha, has been sometimes confounded with the Aśvattha; both trees bear the synonyms Bahupada "many-footed," and Śikhandin "crested," but the Vata is specially described as Skandaja "born of the trunk," Ava-roha-śáyin "sending down branches," Skanda-ruha "growing from its own trunk," Páda-rohana, &c. In Indian mythology an enormous Vata tree is supposed to grow upon mount Supárśva, to the south of the celestial mount Meru, and to cover eleven yojanas; in the Vishun Purana we find a similar account of the Pippala growing on mount Vipula and covering eleven hundred yojanas. Devaki, when pregnant with Krishna, is said to have taken refuge under a Vata tree from Kansa, who had destroyed her first six children. The tree was a

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special favorite of the Buddha, and Arrian speaks of the Indian sages as sitting under it. There is one famous tree mentioned in the *Ramayana*, the *Uttara Rama-charitra*, the *Kurma-purana*, and elsewhere, which still grows on an island in the Nerbudda; it is said to have been planted by the sage Kabira some two thousand years ago, and is popularly known as the *Kabir Bar*. Owing to the peculiar growth of these trees, there is no reason why they should not last for an indefinite period.

The figs of the Udumbara (*F. glomerata*) are considered to be astringent, stomachic and carminative, and are given in menorrhagia and hæmoptysis, in doses of one tola of the dried fruit with sugar and honey. The fresh juice of the ripe fruit is used as a vehicle (*Vern.* अनुपान) for metallic preparations. The juice of the root is used as a tonic, is applied to glandular swellings,* and is given in doses of four tolas with cumin and sugar in gonorrhœa. The small blister-like galls, which are common on the leaves, are soaked in milk and mixed with honey as a remedy for pitting in small-pox. This tree bears the synonyms of Yajniya "sacrificial," Pavitraka "purifier," &c., and is much used in Hindu ceremonial. According to the *Grihya Sutra*, a married woman in the fourth month of pregnancy should be rubbed with the fruit to fortify the germ.

F. Tjakela, in Sanskrit Parkati or Parkatin, Supárśva and Plaksha, is the waved-leaved fig-tree, a sacred tree, but of minor importance. It is the Tsjakala of Rheede.

Mahometan and European writers do not add much to our knowledge of the medicinal properties of these trees. Ainslie, speaking of *F. glomerata*, says:—"From the root of the tree, which in Tamil is called *attievayr*, there exudes, on its being cut, a fluid, which is caught in earthen pots, and which the Vytians consider as a Cúlpám (*Tam.*), that is, a powerful tonic, when drank for several days together. This Cúlpám is termed *attie-vayr tannie*." (*Mat. Ind.*, ii., p. 30.)

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* It is interesting to not that the juice of the *F. Sycomorus*, Linn., the συκομόρος of Dioscorides, and the جميز (Jumíz) of the Arabs, was used by the Greeks, and is still used in Egypt for a similar purpose, and that both trees have much the same habit. (*Dios.*, i., 148, and *Prosper Alpinus*, p. 20). The Indian Mahometans use *F. glomerata* as a substitute for *F. Sycomorus*.

Ainslie also states that the seeds of *F. religiosa* are supposed to possess cooling and alterative qualities, and quotes the following passage from Bartolomeo's *Voyage to the East Indies:* "Pulverised, and taken in water for fourteen days together, the fruit removes asthma, and promotes fruitfulness in women." The tree is the *Areálu* of Rheede, and the *Arbor conciliorum* of Rumphius. (*Mat. Ind.*, ii., p. 25.)

The white glutinous juice of *F. bengalensis* is applied as a remedy for toothache, and to the soles of the feet when cracked and inflamed. The leaves, after they have turned yellow, are given in the Concan with roasted rice in decoction as a diaphoretic; dose, three leaves.

Description.—*F. religiosa*, a tree.—Leaves long-petioled, ovate, cordate, narrow acuminate, acumen one-third the length of the leaf, entire, or repandly undulated towards the apex; fruit-receptacles axillary, paired, sessile, depressed, size of a small cherry, appearing in the hot season and ripening in the rainy season, purple when ripe.

F. bengalensis, a tree.—Branches spreading very much; lower ones rooting; leaves alternate, ovate, bluntly acuminated, with parallel nerves, paler underneath, entire, downy when young, afterwards smooth; fruit-receptacles axillary, paired, sessile, as large as a middle-sized cherry, appearing and ripening in the hot season, red or yellow when ripe.

F. Tjakela, a tree.—Leaves rather long-petioled, membranaceous, oblong, or sublanceolate-oblong, moderately and acutely acuminated, obtuse or rounded, or subcordate at the base, quite entire, or very slightly repand; fruit small, sessile, twin, globose, smooth, when ripe white.

F. glomerata, a tree.—Trunk crooked, thick, bark of a rusty-greenish colour, rough; leaves alternate, petioled, oblong or broad lanceolate, tapering equally to each end, entire, very slightly 3-nerved, smooth on both sides; racemes compound or panicled, issuing immediately from the trunk or large branches; fruit pedicelled, nearly as large as the common fig, clothed with soft down, purple when ripe. For a full

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botanical account of the Genus, the reader is referred to Dr. G King's "*Species of Ficus.*"

Chemical composition.—The bark of *F. religiosa* contains 3·8 per cent. of tannin, that of *F. racemosa* 14·1 per cent., and that of *F. bengalensis* 10·9 per cent. The air-dried bark of *F. racemosa* yields 12·2 per cent. of ash, that of *F. bengalensis* 8·05 per cent., and that of *F. religiosa* 11·7 per cent. The tannin gives a green precipitate with ferric salts. There is nothing else of interest in these barks, except caoutchouc and wax.

FICUS CARICA, *Linn.*

Fig.—*Woodv., t.* 244; *Steph. & Ch., t.* 154; *Reich. Ic. Fl. Germ. xii., t.* 659. The Fig (*Eng.*), Figue (*Fr.*).

Hab.—Persia. Cultivated in India. The fruit.

Vernacular.—Anjir (*Hind., Guz., Mar., Beng.*), Shimai-atti, Tén-atti (*Tam.*), Shima-atti, Téne-atti (*Tel.*), Shime-atti (*Can.*).

History, Uses, &c.—The Fig holds much the same place in the mythology of the West as the *Pipal* and *Bar* do in Indian mythology. It has been regarded from prehistoric times as an anthropogonic tree and valued for its nutritious fruit. It is frequently mentioned in the sacred books of the Hebrews and by early Greek and Latin writers. Hippocrates notices it in several places as having aperient, emollient and nutritious properties, and as being useful as an article of diet in phlegmatic affections. Figs were used in lustration by the Greeks. The celebrated *Ficus ruminalis* of Rome, appears, like the Indian Ásvattha (*F. religiosa*), to have been regarded as a cosmogonic tree. Pliny gives the following description of it:—"Colitur ficus arbor in foro ipso ac comitio Romæ nata, sacra fulguribus ibi conditis. Magisque ob memoriam ejus quæ nutrix fuit Romuli ac Remi conditoris appellata, quoniam sub ea inventa est lupa infantibus præbens *rumen* (ita enim vocabant *mammam*), miraculo ex acre juxta dicato, tamquam in comitium sponte transisset." In the worship of Dionysus, the fig played an important part; the phallus was made of its wood and the

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fruit was a necessary offering to the god. In the early Christian mythology this phallic tree became accursed, the tree of Judas, &c., and was supposed to be haunted by evil spirits, and the early Italian missionaries in India gave the name of *albero del diavolo* to the Indian fig-tree. For a full account of the myths and superstitions connected with the fig, we must refer the reader to De Gubernatis. (*Myth. des Plant.*, ii., 137—143.) The fig appears to have been known to the Arabs and Persians from prehistoric times. Aitchison (*Botany of the Afghan Delimitation Commission, Trans. Lin. Soc.*) gives an interesting account of the wild fig-tree of Eastern Persia, and Abu Hanifeh, author of the *Book of Plants*, describes the fig as wild in the Saráh, and commonly eaten by the people in its fresh state, and also dried and stored. In the chapter of the Koran entitled "The fig" (التين), it is mentioned along with the olive. God, say the commentators, swears by these two fruits, because of their great uses and virtues, for the fig is wholesome and easy of digestion, and medicinally good to carry off phlegm, and gravel in the kidneys or bladder, and to remove obstructions of the liver and spleen, and it cures piles and the gout, &c.

The cultivation of this tree in India was introduced by the Mahometans, and is now carried on by both Mahometans and Hindus in many parts of the country; caprification is not practised, and all the fruit which we have seen is much inferior to that grown in Europe. Two varieties, the purple and the green, are cultivated in the Bombay Presidency, where the area under fig cultivation is about 300 acres; the Hindus are fond of the fruit, which they consider to be cooling and nutrient; they also use the unripe fruit as a vegetable. The fruit of *F. Roxburghii* as grown at Alipore, near Calcutta, attains a large size, and when ripe is of a bright red; it is not unpalatable.

Dried figs were brought to India from Arabia and Persia, long before the tree was cultivated in the country, by the early Arab traders to the Western Coast, and overland from Persia; they are of a small kind, pressed flat and strung upon a string made of camels' hair; when well washed and stewed in syrup

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they are not unpalatable. We have frequently used them for the preparation of confection of senna with satisfactory results.

Description.—A fig consists of a thick, fleshy, hollow receptacle of a pear-shaped form, on the inner face of which grow a multitude of minute fruits. This receptacle, which is provided with an orifice at the top, is at first green, tough and leathery, exuding when pricked a milky juice; on maturity it becomes soft and juicy, and the milky juice is replaced by a saccharine fluid. The orifice is surrounded, and almost closed by a number of scales, near which, and within the fig, the male flowers are situated, but they are often wanting, or are not fully developed. The female flowers stand further within the receptacle, in the body of which they are closely packed; they are stalked, have a five-leafed perianth and a bipartite stigma. The ovary, which is generally one-celled, becomes when, ripe; a minute, dry, hard nut, popularly regarded as a seed. (*Pharmacographia.*)

Chemical composition.—Exclusive of the achenes, which, together with the cellular tissue, Bley (1831) found to constitute about 15 per cent. of the weight of figs, he obtained 16 per cent. of water, 62·5 per cent. of sugar (glucose), the remainder being gum, fat, and saline constituents. The mean of five analyses of dried figs reported by König affords the the following percentage results:—

Water	31·20
Albuminoids	4·01
Sugar	49·79
Ash	2·86

The anhydrous figs contained ·92 per cent. of nitrogen and 2·26 per cent. of sugar.

A. Hansen in 1886 found that the latex of *Ficus Carica* contained principles capable of effecting four fermentative changes; they peptonise albuminoids in the presence of either alkalies or acids, act on starch like diastase, and coagulate the casein of milk. The products of digestion are the same as with pepsin, although the two ferments are not identical. In 1890,

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U. Mussi separated from fig sap a digestive ferment which he named "cradina," from *krade* (κράδη), the name given by the Greeks to the part of the fig with which they associated the digestive property. It contains nitrogen, and differs from pepsin in maintaining its digestive power in an alkaline liquor, and from papain or papayotin in being insoluble in water, not precipitated from solution by alcohol or lead acetate, and in its activity not being diminished in the presence of hydrochloric acid.

The following species of Ficus are also considered to have medicinal properties:—

Ficus Rumphii, *Bl. King Fic.* 54, *t.* 673, 84t; *Wight Ic., t.* 640,—Pákar (*Hind.*), Gai-asvat (*Beng.*), Pair, Ashta (*Mar.*), a native of the hill slopes of North-Western and Central India, is a tree having much the appearance of the Pipal; leaves on very long petioles (6 to 8 in.), broad-cordate, with a short and sudden acumination, rather membranaceous with waved margins, finely reticulated beneath, perfectly smooth; fruit paired, sessile, round, smooth, black, of the size and appearance of a black cherry. The juice is used in the Concan to kill worms, and is given internally with turmeric, pepper and ghí, in pills, the size of a pea, for the relief of asthma; it causes vomiting. The juice is also burned in a closed vessel with the flowers of *Mudar*, and four gunjás' weight of the ashes mixed with honey is given for the same purpose.

Ficus retusa, *Linn. King Fic.* 50, *t.* 61, 62, 84p; *Wight Ic., t.* 642,—Kámrup (*Hind., Beng.*), Yerra-juvi (*Tel.*), Pilaka (*Can.*), Jili (*Tam.*), Nandruk (*Mar.*), a native of the base of the Eastern Himalaya and of the Deccan Peninsula, is used medicinally in rheumatism, the leaves and bark being pounded and applied as a poultice. In the Concan the following prescription is in use for flatulent colic:—Take of Nandruk leaf-juice, Tulsi leaf-juice, and ghí, equal parts; boil until all the water has evaporated; do this again 21 times with fresh quantities of the juice of the two plants; the residuum may then be applied to the belly, and fomentation with a hot brick be practised.

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Rheede notices a similar use of the plant. (*Hort. Mal.*, iii., t. 55.) The juice of the bark has a reputation in liver disease; dose, 1 tola in milk.

Ficus asperrima, *Roxb. Wight Ic., t.* 633,—Kál-umar (*Hind.*), Kara-karbuda (*Tel.*), Khargas (*Can.*), Kharvat, Kharoti (*Mar.*), a native of Central India and the Deccan Peninsula, remarkable for the roughness of its leaves, which are used as sand paper by the natives, and have been given the name of *Folhas da raspa* by the Portuguese, is a small tree with ovate, alternate, very rough leaves of a pale green colour, at the apex of the petiole and in the axils of the leaf-veins there are small shining green glands as in *F. hispida,* except that the glands are more completely in the axils, and appear closed, whereas in the latter plant they have a distinct stoma. The leaves owe their roughness to the presence of calcareous hairs. Both the juice of the plant and the bark are well-known remedies for glandular enlargements of the abdomen, such as liver and spleen. Rheede says that the root taken in the morning with palm vinegar "viscerum ardorem compescit." The bark is brown, scabrous and brittle, and has a bitter and astringent taste.

Chemical composition.—The bark contains a crystalline principle soluble in alcohol, which is precipitated by alkaloidal reagents, and is not coloured by the stronger acids. It also contains an organic acid precipitated by gelatine, and darkened in colour by ferric chloride. The ash of the air-dried bark afforded 18·4 per cent. of white calcareous ash.

Ficus hispida, *Linn. Wight Ic., tt.* 638, 641, the *F. dæmonum* of Kœnig, is the Kakodumbara or Kakodumbarika, "crows' fig," of Sanskrit writers, and is stated in *Madanpal's Nighanta* to have the same properties as *F. glomerata.* It is the Kát-gular of Hindustan, the Kako-dumar of Bengal, the Bokhera or Dhed-umbar of Bombay, and the Pe-attis of Madras. Rheede says that the fruit boiled in goat's milk is used in hepatic obstruction; it has been brought to notice by Mr. M. Sheriff on account of its emetic properties. The shrub has

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opposite, cuneate, oblong leaves, which are scabrous above and downy beneath. The fruit is like a small fig and very downy; it usually grows from the stem near or beneath the ground; an interesting description of it by Dr. G. King forms one of the series of *Scientific Memoirs by Medical Officers of the Army of India*, published at the Government Printing Press, Calcutta. In Bombay and the Concan the powdered fruit heated with a little water is made into a *lep*, or poultice, which is applied to buboes, which it either disperses or brings rapidly to maturity. The fruit is also given to milch-cattle to dry up their milk.

The emetic properties of the plant are due to the presence of saponin.

Chemical composition.—The bark contained 2·1 per cent. of tannin, and some wax and caoutchouc-like substance. No alkaloid was discovered, but a glucosidal principle, having the properties of saponin, was separated from a decoction by barium hydrate. The air-dried bark yielded 13·6 per cent. of mineral matter on incineration.

Ficus gibbosa, *Bl. King Fic.* 4, *t.* 2; *Wight Ic., t.* 650, is a native of the bases of the hill ranges throughout India. It is a climbing shrub, and often a tree with a stem as thick as a man's arm; leaves alternate, very shortly petioled, somewhat ovate, suddenly acuminated, very unequally sided, cuneate toward the base; lateral nerves 3 to 4 on each side, prominent, spreading, uniting in arches, pale green, rough, length 3 to 4 inches, sometimes a little toothed on the margin; fruit small. The *Flora of British India* describes four varieties of this plant. In Western India the root-bark is considered to be stomachic and gently aperient. The Marathi name is Dántira, the Telugu names Konda-juvi and Tella-barinka.

Chemical composition.—The bark contains 4·3 per cent. of tannin; besides some colouring matter, a small quantity of an alkaloidal principle was separated from the tincture, having no very characteristic reactions with the strong acids. The ash of the air-dried bark was 15 per cent.

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ANTIARIS TOXICARIA, *Lesch.*

Fig.—*Bot. Mag. i., t.* 17; *Wight Ic., t.* 1958; *Bedd. Fl. Sylv., t.* 307. The Upas tree (*Eng.*), Antiar vénéneux (*Fr.*).

Hab.—The Deccan Peninsula, Ceylon. The nuts.

Vernacular.—Chándul, Chándakuda, Sápsúndí (*Mar.*), Nettavil-maram (*Tam.*), Jajhugri (*Can.*), Araya-angeli (*Mal.*).

History, Uses, &c.—"Most exaggerated statements respecting this plant were circulated by a Dutch Surgeon about the close of the last century. The tree was described as growing in a desert tract, with no other plant near it for the distance of 10 or 12 miles. Criminals condemned to die were offered the chance of life if they would go to the Upas tree and collect some of the poison. They were furnished with proper directions, and armed with due precaution, but not more than two out of every twenty ever returned. The Dutch Surgeon Foersch states that he had derived his information from some of those who had been lucky enough to escape, albeit the ground around was strewn with the bones of their predecessors; and such was the virulence of the poison, that " there are no fish in the waters, nor has any rat, mouse, or any other vermin been seen there; and when any birds fly so near this tree that the effluvia reaches them, they fall a sacrifice to the effects of the poison. Out of a population of 1,600 persons, who were compelled, on account of civil dissensions, to reside within 12 or 14 miles of the tree, not more than 300 remained in less than two months. Foersch states that he conversed with some of the survivors, and proceeds to give an account of some experiments that he witnessed with the gum of this tree, these experiments consisting principally in the execution of several women, by direction of the Emperor! Now, as specimens of this tree are cultivated in botanic gardens, it cannot have such virulent properties as it was stated to have; moreover, it is now known to grow in woods with other trees, and birds and lizards have been observed on its branches. It occasionally grows in certain low valleys in Java, rendered unwholesome by an escape of carbonic acid gas from crevices in

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the ground, and which is given off in such abundance as to be fatal to animals that approach too closely. These pestiferous valleys are connected with the numerous volcanoes in the island. The craters of some of these emit, according to Reinwardt, sulphureous vapours in such abundance as to cause the death of great numbers of tigers, birds and insects; while the rivers and lakes are in some cases so charged with sulphuric acid, that no fish can live in them." (*Treasury of Botany.*)

In Travancore *A. toxicaria* is known as the *sacking tree*, and is not regarded by the natives as poisonous; the same is the case in Coorg, where sacks and even garments are sometimes made from the inner bark. In the Concan and in Canara the bitter seeds are used as a febrifuge, and as a remedy in dysentery, one-third to one-half of a seed being given three times a day.

The use in the Malayan region of a vegetable poison to tip the bamboo arrows which are discharged from a blowpipe, is too well known to need description. To this the name *Upas* is given in Java, and *Ipoh* by the Malays elsewhere. Both words have the same meaning, and, according to Blume, signify poison. There is no doubt that this poison is the produce of *A. toxicaria.* In 1878, Regnault experimented with a poison used by the savages of Tonkin to poison their arrows, and in a communication to the *Société de biologie* he showed that this substance was a powerful heart poison. Baillon identified the leaves from which the poison was prepared as those of *A. toxicaria.* In 1881, Sir Cecil Smith, then Colonial Secretary to the Straits Settlements, forwarded to Kew a bottle of Ipoh poison as well as foliage specimens of the tree from which it was obtained. These were collected by Sir Hugh Low, then British Resident in Perak, at the Plus River. The poison was subjected to a careful examination by Dr. Sidney Ringer, who reported that it was perfectly inert. The plant seemed identical with that collected by Griffith, and both were identified at Kew with the Javanese *A. toxicaria.* In 1888, Chauvet (*Thèse Bordeaux*) examined the arrow poison of Indo-China, and came to the same conclusions concerning its poisonous properties as were arrived at by Regnault in 1878. In 1889, the Straits

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Government sent to Kew further specimens of *Ipoh* poison, which were again examined by Dr. Ringer with entirely negative results. Botanists were not, however, unprepared for this result. The Dutch botanist, Blume, in his fine work '*Rumphia*,' has given an elaborate account of the Javanese *Upas* and of the tree which yields it (pp. 46—59, tt. 22, 23), but he points out that Rumphius, our earliest authority on Malayan botany, distinguished two kinds of Upas trees, which he termed *Arbor toxicaria femina* and *mas* respectively. Rumphius's *femina* was destitute of any poisonous qualities, and Blume has described it as a distinct species under the name of *A. innoxia* (*Rumphia*, pp. 171—173, t. 54). He received specimens from the island of Timor, where Spanoghe* found that the sap was destitute of any poisonous effect on animals; he also gives Celebes as a locality for the innocuous plant. Other botanists have not, however, found themselves able to attach much weight to the distinctive characters pointed out by Blume, and there can be no doubt that what weighed principally in his mind was the remarkable difference in the properties of the two forms. Species are, however, made by botanists on structural (morphological) differences and not on physiological. In the same species of *Cinchona* it is now known that there are the widest differences in the amount and even nature of the alkaloids which can be extracted from the bark. An equally striking, and even better known instance of differences in properties, unaccompanied by any difference in external characters, is afforded by two well-known British umbelliferous plants, *Œnanthe crocata* and *Cicuta virosa*, which Sir R. Christison found to be innocuous when grown near Edinburgh.

Brandis in his '*Forest Flora*' has identified with *A. innoxia* the *A. saccidora* of South-west India. According to Beddome, this is "the largest tree of the vergreen forests of the Western Ghauts, and the hills betweem taem and the Coast." Sacks are made of the thick woolly fibrous inner bark. The method is thus described

* Spanoghe's account of the innocuous Upas of Timor is printed, together with that of Leschenault on the virulent kind, in Hooker's *Companion to the Botanical Magazine*, Vol. I., pp. 308—317.

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by Graham:—"A branch is cut corresponding to the length and diameter of the sack wanted, soaked a little, and then beaten with clubs till the fibre separates from the wood. This done, the sack formed of the bark is turned inside out, and pulled down, until the wood is sawed off, with the exception of a small piece left to form the bottom of the sack, which is carefully left untouched."

Brandis remarks (*l. c.*, p. 427):—"Another species of the same genus (*Myah seik*, Burm.) is found in the dense evergreen forests of the Thoungyeen Valley. In Tenasserim the juice is used by the Karens to poison arrows, but the poison does not seem equal in its effects to that of the famous Upas tree of the Indian Archipelago." Mason refers the Pegu Upas to *A. ovalifolia*, a very large timber tree scattered in the forests from Mergui to Toungoo. The milky juice is intensely bitter, and when swallowed produces sore-throat. Arrows that have been smeared with it and hung exposed to the air, lose their power to produce death, and there is said to be a difference in the virulence of the poison at different times of the year. Nothing more seems to be known of the tree which yields the Karen arrow poison, but it is very probably referable to *A. toxicaria*, and Gamble (*Manual of Indian Timbers*, p. 332) refers the Burmese name *Myah seik* to that species. (*Archives de Physiologie*, 2,1891; *Kew Bulletin*, 50,1891.)

In 1891, MM. E. Boinet and E. Hedon examined the arrow poison used by the Muongs of Tonkin. They found the quantity of the poison on each bamboo arrow to be about half a gram of a brownish substance soluble in water. Three drops of a solution of 0·50 gram of the poison in 10 grams of water placed upon a frog's heart arrested the pulsations in seven minutes, and a subcutaneous injection of one centigram of the poison proved fatal to a guinea pig. From twenty experiments, it was found that one centigram per kilo body-weight was rapidly fatal to the animals experimented upon.

The authors arrive at the following conclusions:—

1*st.*—That the poison has no appreciable effect upon the nervo-muscular or central nervous system.

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2nd.—The breathing is accelerated for a few minutes after the injection of the poison, but afterwards the number of respirations gradually decreases until death takes place.

3rd.—The final effect of the poison is to stop the heart in systole.

In the poisoned frogs the ventricle was contracted, empty, hard and white. In the mammal the left ventricle was smaller and harder than usual, the right ventricle less contracted and full of dark blood. Before final stoppage the heart symptoms may be divided into several stages. In mammals, at a certain period after the injection of the poison, a sudden want of rythm was observed, the heart beating very irregularly. Afterwards the pulsations became more and more feeble, with occasional stronger contractions, and finally periods of great depression alternating with periods of stronger pulsation were observed. In all cases a few auricular pulsations occurred after stoppage of the ventricles. It was remarked also that pulsation could be re-induced by mechanical or electrical stimulation of the heart muscle.

In the frog the first effect of the poison on the heart is a very marked doubling of the pulsations. Whereas in the normal condition the auricular contraction immediately precedes the ventricular, and is shown on the pulse tracing by a slight hitch in the curve of the total pulsation; in the poisoned animal the two pulsations are separated by a marked interval, and finally the auricular curve becomes so marked as to equal or even exceed in size the gradually decreasing ventricular curve.

In the second stage the ventricle only contracts once to several auricular contractions, that is, it only contracts when it has become sufficiently distended with blood to excite contractions.

In the last stage the strength of the auricular contractions gradually decreases, the ventricle remaining immovable, empty, and contracted. The authors conclude that the poison acts upon the intracardiac ganglia and not upon the central nervous system.

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The poison, we are informed, is prepared by the natives of Tonquin from the leaves of *A. toxicaria*, and experiments made by the authors with the leaves of that plant prove clearly that they are the only active ingredient in the arrow poison. (*Archives de Phys.*, 1891, p. 373.)

A still more recent investigation of the Ipoh poison by Mr. L. Wray, the Curator and State Geologist of Perak, has been published in the *Perak Gazette*. He says:—The Samangs get the sap from the tree by scoring the bark. The sap is heated on a spatula till evaporated, leaving a dark gummy substance in which the arrows are dipped; 3½ ounces of sap will do for poisoning 100 arrow points. The sap was bitter and biting in taste and decidedly acid to test paper; when exposed to the air it darkens to a brown colour, and yields when dried 29 per cent. of Ipoh. If this substance is placed on a glass slide and examined under a microscope it is seen to contain numerous crystals of antiarin. Some fruiting specimens of the Ipoh were sent to Kew in 1883, and were pronounced to be identical with the Javan specimens of *A. toxicaria*. With reference to the two kinds of Upas distinguished by Blume as *Arbor toxicaria femina et mas*, the latter word in Malay means "gold"; it is so called from the golden colour of the inner bark. In the innocuous variety, so say the Samangs, the inner bark is blackish coloured, and so they distinguish the poisonous from the non-poisonous trees. They have never mixed arsenic with the sap. One fluid ounce of Ipoh sap was found to yield 10·85 grains of antiarin or 2·482 per cent. The dried Ipoh poison, of which the sap contains 29 per cent., therefore has 8·56 per cent. of antiarin in it. 0·086 of a grain of the dried poison is enough to kill an animal weighing 20 lbs., when introduced into the circulation. Fowls and pheasants are proof against the poison, but a cat struck with a poisoned dart died within 19 minutes. Mr. Wray's Report has since been published in the *Kew Bulletin* for October and November 1891.

Description.—The nuts are sub-globular, the size of a marble, of a light-brown colour, and have a slightly prominent umbilicus; they are enclosed in a sweet greenish-yellow pulp,

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forming a small one-seeded fig with a rich purple bloom. The shell is thin and fragile, the kernel, loose inside the shell, is of the size of a large pea, brown, sub-globular, rugose, especially upon the flatter side; substance hard and very bitter.

Chemical composition.—When the sap of the tree is exhausted with boiling alcohol, a mixture of vegetable albumin, gum and wax remains undissolved, while a solution is formed, which throws down, on cooling, wax, antiar-resin, and albumin. On removing the sediment and evaporating, more resin and wax are deposited, and the solution dries up at last to an extract, from a solution of which in boiling water *Antiarin*, $C^{14}H^{20}O^{5}+2H^{2}O$, amounting to 3·5 per cent. of the dried sap, crystallises. The crystals are purified by washing and recrystallisation. Antiarin forms splendid silvery laminæ resembling malate of lime.

The flakes which separate from the alcohol after boiling it with the sap of *A. toxicaria*, consist of *Antiar-resin*, $C^{32}H^{24}O^{2}$, which may be obtained white by re-solution in boiling alcohol; when dry it has a glassy fracture, but becomes pasty if warmed. It is not poisonous, whilst antiarin causes death if introduced into the circulation in minute portions. (*Mulder in Gmelin's Handbook*, Vol. XVI., p. 217.)

The wax deposited on cooling from an extract of the juice prepared with hot alcohol, and purified by boiling with water, is white and brittle, softening at 30°, and melting at 35°, sp. gr. 1·016 at 20°. It is decomposed by nitric acid, blackened by sulphuric acid, and not affected by hydrochloric acid or potash-ley. It is soluble in alcohol and ether, especially on boiling. Average composition 77·29 per cent. Carbon, 11·71 H, and 11 O. (*Ibid.*, Vol. XVIII., p. 158.)

The seeds of the Indian plant, collected in Savant Vádi, contain a crystalline principle, very bitter and poisonous, resembling, if not identical with, antiarin. It is soluble in water, alcohol, and very slightly in ether. It gives a reddish-brown colour with sulphuric acid, and a yellowish or orange colour with nitric acid. On allowing the dried extract to stand, it does not readily crystallize out, but if the alcoholic extract is dissolved in water, in which it is quite soluble (showing

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absence of resinous matter), and the solution agitated with crude ether, crystals can be obtained from the decanted ethereal layer. The solution also reduced Fehling's solution. About 2 per cent. of fat, 11·33 of water, and 3·46 of ash were separated from the air-dried seeds.

The juice of **Artocarpus integrifolia**, *Linn.*, the well-known Jack tree, in Sanskrit Panasa, heated over the fire, is a popular cement for joining broken China and stoneware. The deposit from the milky juice is insoluble in water, partly soluble in alcohol, and entirely so in benzol. It is a variety of caoutchouc, and in the natural state can be used as a birdlime, or as a cement for broken articles; after being washed in boiling water it becomes harder, and may be used for all the ordinary purposes of India-rubber. The yellow dye which is obtained from the wood is of a resinous nature, and may be extracted by boiling water or alcohol. The juice of **A. Lakoocha**, *Roxb.*, or one or two of the seeds, is a popular purge in Bengal; the tree is the Dahu of Sanskrit writers. Rheede states that the dry leaves and juice of **A. hirsuta**, *Lamk.*, together with zedoary and camphor, are applied to buboes and swelled testicles. The dried juice breaks with a resinous fracture, is only partly soluble in alcohol, wholly soluble in benzol and petroleum ether. The tree yields the Anjelly wood of South India, and is called Ayani in Malabar, where it is very abundant.

MYRICACEÆ.

MYRICA NAGI, *Thunb.*

Fig.—*Bot. Mag., t.* 5727; *Wight Ic., t.* 764, 765.

Hab.—Subtropical Himalaya. The bark.

Vernacular.—Kaiphal, Kátphal (*Hind., Guz., Beng.*), Kaya phala (*Mar.*), Marudam-pattai (*Tam.*), Kaidaryamu (*Tel.*), Marutam-toli (*Mal.*), Kirishivani (*Can.*).

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History, Uses, &c.—The bark of this tree is its most valuable product, and is largely exported to the plains. It is called in Sanskrit Katphala, and bears among other synonyms those of Kumuda, Kumbhi-pćki, Sriparnika, Somavalka, and Mahakumbhi. According to the Nighantas, it is useful in diseases caused by deranged phlegm, such as fever, asthma, gonorrhœa, piles, cough, and other affections of the throat. It is an ingredient in numerous formulæ for these diseases, such as the *Katphaladi churna*, for which Sarangadhara gives the following prescription:—Take of the bark of *M. Nagi*, tubers of *Cyperus rotundus* (Mustaka), root of *Picrorhiza Kurrooa* (Katuki,), *Curcuma Zedoaria* (Sati), galls of *Pistacia integerrima* (Karkata-sringi), and root of *Saussurea Lappa* (Kushta), equal parts; powder and mix. This powder is given in doses of about a drachm with the addition of ginger juice and honey in affections of the throat, cough and asthma. The powdered bark is used as a snuff in catarrh, and mixed with ginger as an external stimulant application in cholera, &c.

Under the names of Dár-shishaán, Kandúl, and Úd-el-bark, Mahometan writers state that the bark is resolvent, astringent, carminative, and tonic; that it cures catarrh and headaches; with cinnamon they prescribe it for chronic cough, fever, piles, &c. Compounded with vinegar it strengthens the gums and cures toothache; an oil prepared from it is dropped into the ears in earache. A decoction is a valuable remedy in asthma, diarrhœa and diuresis; powdered or in the form of lotion the bark is applied to putrid sores; pessaries made of it promote uterine action. The usual dose for internal administration is about 60 grains. *Duhn-el-kandúl*, an oil prepared from the flowers, is said to have much the same properties as the bark. We have never met with it, nor does it appear to be known in commerce.

Description.—Bark half an inch thick, externally scabrous, pitted from the separation of pieces of suber, of a mottled rusty-brown and dirty white colour, suber warty; substance of bark and inner surface of a deep dull red colour; when soaked in water it produces a deep red solution; taste strongly astringent.

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Microscopic structure.—Within the suberous layer is a remarkable stratum of stony cells; the parenchyma throughout is loaded with red colouring matter, and permeated by large laticiferous vessels, from which a gummy latex exudes when the bark is soaked in water.

Chemical composition.—The bark of *M. Nagi* contains 14 per cent. of tannin, which gives a purplish colour with ferric salts, but the tincture and decoction give a greenish colour owing to the presence of colouring matter in the bark. The ash of the air-dried bark amounts to 7·17 per cent.

When the bark is exhausted by water and the water evaporated, a brittle shining extract is obtained of a reddish-brown colour, which contains 60 per cent. of tannin with some saccharine matter and salts.

Commerce.—The bazaars are supplied from Northern India; about 50 tons of the bark are collected annually in the Kumaon forests. It is always obtainable in native drug shops. Value about Rs. 2 per maund of 41 pounds.

CASUARINEÆ.

CASUARINA EQUISETIFOLIA, *Forst.*

Fig.—*Beddome, Forester's Man., t.* 226. Tinian Pine (*Eng.*), Filao de l'Inde (*Fr.*).

Hab.—East side of the Bay of Bengal. Cultivated elsewhere. The bark, leaves, and seeds.

Vernacular.—Sinyu (*Burm.*), Chouk (*Tam.*), Sarva (*Tel.*), Kásrike (*Mysore*), Aru (*Mal.*), Viláyati-saru (*Mar.*).

History, Uses, &c.—This tree is distributed through Chittagong, Burma, the Malay and Pacific Islands, and Australia, and is much cultivated on the coasts of India. In

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Australia it is called the swamp oak. Dr. Bennett (*Gatherings of a Naturalist in Australia*) remarks: –"Their sombre appearance causes them to be planted in cemeteries, where their branches give out a mournful sighing sound, as the breeze passes over them, waving at the same time their gloomy hearse-like plumes." The wood from its red colour is called in the colonies *Beef-wood*, and is much used for fuel, and as a timber on account of its hardness. The bark is astringent, and the ashes of the tree yield a quantity of alkali. The bark is used by the Madras fishermen for dyeing their nets. Rumphius notices the use of a decoction of the bark for a bath in Beri-beri, and of a decoction of the leaves in colic. The pounded seeds, he says, are used as a plaster in headache.

According to Corre and Lejanne (*Mat. Med. et Tox. Colon.*), the bark contains one-fifth of its weight of tannin and one-twelfth of *Casuarine*, resin, and colouring matter. A decoction, extract, tincture and syrup are used by the French in Tahiti, Cochin-China, and the Antilles as an astringent. We have observed that the tree yields an inferior sort of gum, not likely to be of much value on account of its deep colour and insolubility in water.

Description.—Bark never very thick, brittle, breaking with a coarse fibrous fracture, substance very hard, fibrous, and of a pink colour; internal surface striated; external surface covered with a scabrous grey suber, readily separating in flakes, and displaying a thin brown suberous layer closely adhering to the liber; taste strongly astringent; odour not peculiar.

Chemical composition.—The bark yielded 18·3 per cent. of tannic acid, giving a blue-black precipitate with ferric salts, and a bulky precipitate with gelatine. The alcoholic extract contained no alkaloidal principle, but a very small quantity of a crystalline neutral principle was shaken out of the watery solution of the extract by ether; it was not coloured by strong acids.

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CUPULIFERÆ.

BETULA UTILIS, *Don.*

Fig.—*Regel Monogr.* 58, *t.* 6, *f.* 13-19; *t.* 13, *f.* 7-14; *Jacq. Voy. Bot.*, *t.* 158. Himalayan Birch (*Eng.*), Bouleau á papier (*Fr.*).

Hab.—Temperate Himalaya, Afghanistan.

BETULA ALNOIDES, *Ham.*

Fig.—*Brand. For. Fl.*, *t.* 56; *Regel Monogr.* 61, *t.* 6, *f.* 32-34; *t.* 13, *f.* 29.

Hab.—Temperate and subtropical Himalaya. The bark.

Vernacular.—Bhujpatar (*Ind. Bazaars*).

History, Uses, &c.—These trees require a brief notice, as the bark, in Sanskrit Bhurjapatra, is much used all over the country for writing medicinal charms on, and is to be found in every druggist's shop. This bark is well-known as the material upon which the ancient Sanskrit manuscripts of Northern India are written. Dr. Bühler, in his account of a tour in Cashmere in search of Sanskrit manuscripts, says:—"The Bhurja MSS. are written on specially prepared thin sheets of the inner bark of the Himalayan birch, and invariably in Sârada characters. The lines run always parallel to the narrow side of the leaf, and the MSS. present, therefore, the appearance of European books, not of Indian MSS., which owe their form to an imitation of the *Talapatras.* The Himalayas seems to contain an inexhaustible supply of birch-bark, which in Cashmere and other hill countries is used both instead of paper by the shop-keepers in the bazaars, and for lining the roofs of houses in order to make them water-tight. It is also exported to India, where in many places it is likewise used for wrapping up parcels, and plays an important part in the manufacture of the flexible pipe-stems used by hukâ-smokers. To give an idea of the quantities which are brought into Srinagar, I may mention that on one single day

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I counted fourteen large barges with birch-bark on the river, and that I have never moved about without seeing some boats laden with it. None of the boats carried, I should say, less than three or four tons' weight.

"The use of birch-bark for literary purposes is attested by the earliest classical Sanskrit writers. Kalidâsa mentions it in his dramas and epics; Susruta, Varahâmihira (*circa* 500-550 A. D.) know it likewise. Akbar introduced the manufacture of paper, and thus created an industry for which Cashmere is now famous in India. From that time the use of birch-bark for the purpose of writing was discontinued, and the method of preparing it has been lost. The preparation of the ink, which was used for Bhûrja MSS., is known. It was made by converting almonds into charcoal and boiling the coal thus obtained with *gomûtra* (urina bovis); this ink is not affected by damp or water." (*Journal, Bombay Branch Royal Asiatic Society*, Vol. XII., No. XXXIV. A.)

QUERCUS INFECTORIA, *Olivier.*

Fig.—*Bentl. and Trim., t.* 249; *Olivier, Voy. dans l'Emp. Oth. ii.*, p. 64, *Atlas, tt.* 14, 15; *Steph. & Church, t.* 152. Dyers' oak (*Eng.*), Chêne à la galle (*Fr.*).

Hab.—Asia Minor, Syria, Turkey. The galls.

Vernacular.—Májuphal, Máphal (*Hind., Beng.*), Maiphala, Mája (*Mar.*), Máshik-káy (*Tam.*), Máshi-káya (*Tel.*), Máchi-káyi (*Can.*), Mayaphal (*Guz.*).

History, Uses, &c.—The Sanskrit name for galls is Máyin or Máyika, and signifies "magic," the gall-nut being used in India in magic rites.

Galls were well known to the Greeks and Romans, who used them medicinally on account of their astringent properties.* India has probably been supplied with them from an early date, *viâ* the Persian Gulf, the greater portion being still shipped at Basra on board Arab vessels, hence the names Basra

* Compare with Dios., i. 127. περὶ κηκίδων; and Pliny, 16, 9, and 24, 5.

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and Maka galls. The medicinal uses to which galls are put in India hardly differ from those with which we are familiar. The Hindus divide them into two kinds, black and white, and generally prescribe both kinds together in the same prescription. Mahometan writers direct the dark-coloured unperforated galls to be selected as the best.

The Arabs call them عفص (*afs*), and say that the tree, which is not of the land of the Arabs, bears one year galls and another Ballút (acorns). In Persia they are known as Mázú or Mázún; the author of the *Burhán* says they are used by tanners, و زنان هم گاهي بجهتہ تنگي موضع مخصوص بکار برنده

In modern medicine tannic and gallic acids obtained from galls are generally used in preference to the raw material.

The action of tannin is chiefly local, and is due to its power of coagulating albumen; it is therefore a useful application when the skin has been deprived of its epidermis by diseases such as intertrigo, impetigo and eczema, as it forms with the exudations a protective coating, and at the same time contracts the cells of the skin.

When applied to a mucous membrane, it causes dryness, coagulation of mucus, and destroys to a great extent the sensibility of the membrane; on this account it is employed in stomatitis, sore-throat, and cough due to irritation at the back of the pharynx, and also as an injection in chronic discharges from the genito-urinary passages.

When taken into the stomach in large doses it causes irritation, and possibly vomiting, but in smaller doses it is often useful in hæmatemesis and intestinal hæmorrhage by coagulating the blood and thus acting as a styptic. In poisoning by the alkaloids it acts as a chemical antidote by forming tannates which are but sparingly soluble in the juices of the alimentary canal; it is also used as an antidote in poisoning by tartar emetic, with which it forms an insoluble tannate. When used as an antidote its administration should be followed by a purgative, as the tannates of the alkaloids will be partially redissolved, if allowed to remain in the intestines.

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Dr. R. Stockman has conducted a series of careful experiments with gallic and tannic acids, with the object of determining the influences which the vegetable astringents exert upon the blood-vessels and animal tissues after absorption. He finds that tannic acid on its entry into the stomach forms alkaline tannates and tannates of albumin. A part of it, and sometimes the whole, is converted into gallic acid in the stomach and intestines, and it is difficult to find a trace of tannic acid in the blood, although it can be detected in the urine. Dr. Stockman comes to the conclusion that tannic acid enters the circulation in combination with alkalies and albumin, and is excreted with such rapidity that only a trace of its presence can be detected in the blood, but that its presence in the genito-urinary tracts and in greater quantity in the intestines can be readily shown. It does not appear to be excreted by the mucous lining of the air passages. It was found that the urine of dogs, rabbits, and human beings, after the administration of tannic acid, contained gallic acid and only a small quantity of tannic acid, but when tannate of soda was administered the urine contained a large proportion of tannic acid and but little gallic acid. These results may be explained in the following manner:—When free tannic acid is brought in contact with the contents of the stomach, it is chiefly converted into tannate of albumin, only a small quantity of alkaline tannate being formed. The tannate of albumin being very insoluble is retained for a long time in the intestines, until it is in a condition to be converted into gallic acid, in which form it is at length absorbed; on the other hand, the alkaline tannate is at once absorbed and passes off in the urine. Under these circumstances, the administration of tannate of soda naturally gives rise to the presence of a large proportion of tannic acid and a small proportion of gallic acid in the urine.

Dr. Stockman did not find pyrogallic acid in the urine, but this experience is in opposition to that of other experimenters.

When gallic acid was administered, that acid only was found in the urine.

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According to Dr. Stockman, tannic acid exerts no action upon the urinary excretion, and gallic acid does not cause contraction of the blood-vessels, but on the contrary dilates them even after contraction has been induced by the action of an alkaline liquid. The neutral gallate of soda, in which form gallic acid circulates in the blood, was found to have no action upon the vessels.

Catechu-tannic acid and Rhatania-tannic acid gave the same results; tannic acid being insoluble in a solution of chloride of sodium could not be experimented with in this manner. Alkaline tannates and tannates of albumin did not affect the calibre of the vessels. Fikentscher has stated that tannic acid administered hypodermically to frogs stimulates the vaso-motar centres and increases the blood pressure, but Dr. Stockman found that gallate and tannate of soda administered in this way to rabbits did not affect the pressure. Pyrogallic acid yielded similar results.

As regards the therapeutic value of gallic acid as a local application or when absorbed into the blood, Dr. Stockman considers that it has no special astringent action, but that it diminishes the alkalinity of the blood and increases its tendency to coagulate: as a local application it is useless. Tannic acid precipitates albumin and forms a protective layer of tannate, which is advantageous in certain diseased conditions which we have already noticed. In its passage through the kidneys it is very doubtful whether it exerts any therapeutic action, but Ribbert considers that it lessens the exudation of albumin in albuminuria. Tannic acid is sometimes injected into the rectum to destroy thread worms, which it does by coagulating the albumin in their delicate tissues.

Description.— Two kinds of gall are found upon Oak trees, hard and soft; the former are the galls of commerce, and are produced by a Cynips which punctures the buds of the tree and deposits its egg in the puncture; the latter result from the puncture of an aphis.

Gall-nuts are globular or pyriform bodies, studded with numerous tuberosities; those which still contain the insect are

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of a blackish or bluish-green colour and heavy; those from which the insect has escaped are of much lighter colour, generally yellowish-white, on one side a round hole may be perceived; they are also lighter in weight and less astringent. When a gall is cut in two a round cavity is seen in its centre, which may or may not be occupied by the insect; in the latter case a passage leads from the cavity to the exterior.

Microscopic structure.—The contents of the central cavity, if present, are seen to consist of a starchy parenchyme destined to supply food to the larva. The walls of the cavity are formed of stone-cells. The bulk of the gall consists of cells arranged in a radiating manner, many of them containing colouring matter and tannin. Towards the exterior of the gall the cells contain dark-coloured chlorophyl; on the very surface the cells are small and thick-walled and form a kind of rind.

Chemical composition.—The principal constituent of galls is tannin or tannic acid. The tannin of different plants possesses distinctive characters; that obtained from galls is known as gallo-tannic acid. It is identical with the tannin of *Rhus coriaria*, Linn. (Sumach).

Galls afford from 60 to 70 per cent. of tannin, and about 2 per cent. each of gallic and ellagic acids.

Commerce.—Galls are imported from Basra and the Persian Gulf ports. Value: White, Rs. 10 per maund of 37½ lbs.; Blue, Rs. 17. Imports about 1,400 cwts. yearly.

SALICINEÆ.

SALIX CAPREA, *Linn.*

Fig.—*Eng. Bot.*, 1488; *Reichb. Fl. Germ.*, *t.* 577. Great round-leaved Sallow, Goats' Sallow (*Eng.*), Marceau, Marsault (*Fr.*).

Hab.—Persia, Europe. Cultivated in N.-W. India. The bark, leaves, seeds, and flowers.

Vernacular.—Bédmishk (Indian Bazars).

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History, Uses, &c.—The willow ἰτέα was well-known to the ancient Greeks, and the Greek name is considered to be cognate to the Sanskrit Vitika, the old German Wida, and the old English With or Withy. Herodotus (i.,194) mentions it, and Theophrastus (H. P. iii., 13) mentions two kinds, λευκή and μέλαινα. Dioscorides (i.,121) notices its astringent properties, and the various medicinal uses to which the bark, leaves, seed and juice were put. Pliny (17, 20) describes the cultivation of the willow, and (24, 9) its medicinal properties. The ancients considered it to be very cooling, "Porro impediunt et remittunt coitum folia salicis trita et epota"; it was also thought to occasion sterility in women. The concrete juice of the plant mentioned by Greek and Latin writers is considered by Fée to have been a kind of manna.

Ibn Sina, under the name of Khiláf, follows Dioscorides closely in his description of the medicinal uses of the willow, but he mentions the use of the flowers of *S. Caprea* separately under the name of Behramaj, a corruption of the Persian Behrameh. The Mahometan physicians all mention the juice or gum (صمغ) of the plant, and Haji Zein states that it exudes from the leaves. It is probably the substance described by M. Raby (*Union Pharm.*, May, 1889), under the name of *Bidenguébine* or "willow honey," said to be derived from the leaves and young branches of a willow, and to have a feebly saccharine taste.

In Persia *S. Caprea* is known as Bid-i-Balkhi, and its flowers as Bidmishk; willow bark is still a popular febrifuge in that country. Aitchison mentions the following species of Salix as occurring wild or cultivated in Persia:—*S. pycnostachya*, Anders., *S. acmophylla*, Boiss., *S. babylonica*, Linn., *S. Daviesii*, Boiss., *S. alba*, Linn., *S. songarica*, Anders., and *S. Caprea*, Linn.

In China and Persia the tree is considered to be symbolic of immortality. *S. babylonica* is planted in burial grounds in the latter country, and has been introduced into India by the Moghals for this purpose; among the Romans it was sacred to

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Juno Fluonia. For an account of the funereal use of the willow in China, the reader is referred to Schlegel's *Uranographie Chinoise*, or De Gubernatis' *Myth. des Plantes*, article *Saule.*

The Persian settlers in India have introduced the flowers (*bidmishk*) and the distilled water (*ma-el-khiláf*) of *S. Caprea*, both of which are used by the upper classes of Mahometans and Parsees, who consider them to be cephalic and cardiacal, and use them as domestic remedies in almost every kind of slight ailment.

Raughan-i-bid, an oil prepared by boiling two parts of the distilled water with one of sesamum oil until the water has all evaporated, is a favorite remedy for cough.

For a long series of years the willow fell into disuse in Europe, but was again brought into notice in 1763 by the Rev. Mr. Stone, who published a paper on the efficacy of the bark of *S. alba* as a remedy for agues. The broad-leaved willow bark (*S. Caprea*) was subsequently introduced into practice by Mr. James, whose observations on its efficacy were afterwards confirmed by Mr. White and Mr. G. Wilkinson (*Pereira, Mat. Med.*, ii., Pt. 1, p. 337). Willow bark was formerly official in the London, Edinburgh, and Dublin Pharmacopœias, and was considered no bad substitute for cinchona in agues. *S. Caprea* is one of those willows which yield *salicin* and tannin, and is remarkable for its large yellow fragrant catkins.

Salicin, which was discovered in 1825, and first obtained in a pure state in 1830, was at first much vaunted as an antiphlogistic by Riess and others in those cases in which salicylic acid is now employed; it was also used as an antiperiodic in ague, and is said to have been found efficient in preventing the development of acute coryza and influenza, and in mitigating the symptoms of hay fever. It was usually administered in 10-grain doses frequently repeated. More extended experience, however, led to the conclusion that it has little or no influence upon the temperature, and the drug gradually fell into disrepute until the discovery of the antiphlogistic properties of salicylic

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acid, when it was again experimented with by Ringer and Bury, who showed that it had no influence upon the temperature of healthy children. They observed that under full medicinal doses a dusky flush suffuses the face on slight excitement, while the expression becomes dull and heavy. Less constant symptoms are deafness, noises in the ears, frontal headache, trembling of the hands and quickened breathing. Very large doses occasion severe headache, marked muscular weakness, tremor and irritability, with a rapid and feeble pulse.

Description.—Catkins 1—2 inches long, thick, cylindrical, bright yellow, fragrant; bracts oblong, small; scales obovate, blackish, hairy; nectary ovate, papillary; stamens longer than the scales, with oblong yellow anthers; germ ovate-lanceolate, silky, on a hairy stalk; style hardly any; stigma oblong, thick, undivided. Bark purplish-brown externally, minutely downy when young, internally white; tough and fibrous.

Chemical composition.—Willow bark has been shown to contain *salicin*, wax, fat, gum, and a tannin which gives with ferric salts a blue-black precipitate, the liquid becoming purplish-red on the addition of soda. Johanson (1875) has also shown the presence of a kind of sugar having a slightly sweet taste and reducing alkaline copper solution with difficulty, and of the glucoside benzohelicin, $C^{20}H^{20}O^{8}$. Salicin, a glucoside, crystallizes in colourless plates or flat rhombic prisms, but it usually occurs in commerce in white glossy scales or needles. It remains unaltered in the air, is neutral to test-paper, inodorous, and has a persistently bitter taste. It is soluble in about 30 parts of water at 11·5° C., and is somewhat less soluble in alcohol. It dissolves in 0·7 part of boiling water and in 2 parts of boiling alcohol. (*United States Pharm.*) Cold sulphuric acid dissolves salicin with a bright red colour; after the absorption of water from the air (but not after the addition of water or after being neutralized by an alkali), the solution deposits a red powder (*rutilin*), which after washing is yellowish-red, after drying blackish-brown, insoluble in water, alcohol,

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and glacial acetic acid, and is coloured violet-red by alkalies. (*Braconnot.*) On warming salicin with somewhat diluted sulphuric acid and potassium bichromate, *salicylous acid* or *salicyl-aldehyd*, $C^7H^6O^2$, is given off, recognizable by its peculiar fragrance, resembling that of meadow-sweet (*Spiræa ulmaria*).

Salicin when digested with emulsin or saliva, or heated to 80°C. with dilute sulphuric acid, assimilates 1 molecule of water, and is split into glucose and *salicylic alcohol* or *saligenin*, $C^7H^8O^2$, which crystallizes in pearly tables, is easily soluble in hot water, alcohol, and ether, melts at 82°C., and sublimes at 100°C. Saligenin is characterized by yielding in solution a deep-blue colour with ferric chloride, and when boiled with dilute acids by being converted into a resinous body, *saliretin*, $C^{14}H^{14}O^3$, while oxidizing agents convert it into salicylous and salicylic acids. Cold nitric acid, sp. gr. 1·16, oxidizes salicin, with the production of *helicin*, $C^{13}H^{16}O^7$, which crystallizes in white needles, and is by ferments and dilute acids resolved into sugar and salicylic aldehyd. If nitric acid of sp. gr. 1·09 is employed, salicin yields *helicoidin*, $C^{26}H^{34}O^{14}$, which may be regarded as a compound of salicin and helicin. (*National Dispensatory.*) For a full account of these interesting reactions, the reader is referred to *Watts' Dict. of Chemistry*, Vol. V., p. 147.

Bidangubin or "willow honey" has been examined by Raby (*Union Pharm.*, May, 1889, p. 201). It affords about 12 per cent. of sugar, estimated as glucose, and a considerable quantity of a sugar crystallizing in opaque hard crystals like those of sugar of milk. It melts at 150° to a transparent liquid, and dissolves in 5·5 parts of water at 15° C. The formula is given as $C^{12}H^{22}O^{11}$. This sugar evidently possesses considerable affinity to melezitose, from which it differs, according to M. Raby, in not being efflorescent, and in the greater rotatory power of the glucose derived from it by inversion over that obtained from melezitose. The inversion by means of dilute hydrochloric acid also takes place more rapidly. He therefore proposes to call the new sugar *bidenguébinose*.

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GNETACEÆ.

EPHEDRA VULGARIS, *Rich.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 539 ; *Bertolon. Miscell. xxiii., t.* 3.

Hab.—Temperate and Alpine Himalaya, Europe, W. and Central Asia, Japan.

EPHEDRA PACHYCLADA, *Boiss.*

Hab.—Western Himalaya, Afghanistan, E. Persia.

Vernacular.—*E. vulgaris*—Amsánia, Butshur, Cheva (*Punj.*), Khanda, Khama (*Kuuawar*), Phok (*Sutlej*), Ma-oh (*Japan*). *E. pachyclada*—Hum, Huma (*Pers., Bomb.*).

History, Uses, &c.—These two species are hardly different; *E. pachyclada* is rather more robust than *E. vulgaris* and more scabrid. Of the former, Sir J. D. Hooker remarks:— "I can find no good characters in the spikes and flowers, except the more or less margined bracts." A specimen of the Persian plant kindly furnished to one of us by Mr. K. R. Cama of Bombay, was identified at Kew as *E. vulgaris.* Dried branches of the Huma are still brought from Persia to India for use in Parsi ceremonial, and it is considered to have medicinal properties. The plant was used by the ancient Arians, and is probably the same as the Soma of the Vedas. Aitchison (*Proc. Linn. Soc.*, x., 77) notices the medicinal use of *E. vulgaris* in Lahoul, and he and Griffith state that the ashes of *E. pachyclada* are used as a snuff and dye in Afghanistan. Dr. N. Nagai of Tokio, Japan (*Berl. Klin. Wochenschr.*, 1887, 706), first drew attention to the fact that *E. vulgaris* contains an alkaloid (*ephedrine*) which possesses the property of dilating the pupil of the eye, and which may be used in the place of atropine. T. V. Biektine (*Bolnitch. Gaz. Botkina*, 1891, No. 19, pp. 473—476) has brought to notice the use of a decoction of the stems and roots of *E. vulgaris* as a popular remedy for rheumatism and syphilis in Russia, and of the juice of the berries in affections of the respiratory passages. After

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administering the decoction himself in a number of cases of rheumatism, acute and chronic, he comes to the conclusion that the plant is especially valuable in acute muscular and articular forms of the disease: the pain is relieved, the pulse becomes less rapid and softer, and the respiration easier. Within 5 or 6 days the temperature becomes normal, the swelling of the joints disappears, and after about 12 days' treatment the patient is cured. In several cases marked diuresis was observed before or about the time that the temperature began to decrease; the drug was also observed to improve the digestion and promote the action of the bowels. In chronic cases the action of Ephedra was less marked, and in two cases of rheumatic sciatica and osteo-myelitis hardly any effect was produced, but it is only fair to remark that antipyrine, salicylate of soda, antifebrine, salol, &c., also failed to afford relief in these two cases. The decoction used by Dr. Biektine was made with 3·85 grams of the drug to 180 grams of water. Kobert has shown that 0·20 gram of ephedrine injected into the veins of dogs and cats produces violent excitement, general convulsions, exopthalmia and mydriasis. (*Nouveaux Remèdes*, Aug. 8th, 1891.)

Description.—*E. vulgaris* is a low-growing, rigid, tufted shrub, with usually a gnarled stem and erect green branches which are striate and nearly smooth. Bracts connate to the middle, not margined, eciliate, rarely produced into minute linear leaves. Spikelets ¼ to ⅓ inch, subsessile, often whorled; fruiting with often fleshy, red, succulent bracts, 1 to 2 seeded. Seeds bi-convex or plano-convex.

E. pachyclada has the same characters, but is usually more scabrid. Sir J. D. Hooker remarks:—"I have many specimens from N.-W. India that I do not know whether to refer to *vulgaris* or *pachyclada*." The twigs of these plants have a terebinthinate and astringent taste, and sections when magnified show the tissues to be loaded with an inspissated red juice.

Chemical composition.—Dr. N. Nagai (*Tokio Chem. Society*, through *Chem. Zeit.*, 1890, p. 441) obtained the alkaloid *Ephedrine* from the stem of *Ephedra vulgaris* (Ma-oh). Its

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composition is $C^{10}H^{15}NO$; by oxidation the alkaloid is split into benzoic acid, monomethylamine and oxalic acid. *Isoephedrine,* melting point 114°C., is obtained by heating ephedrine, melting point 30°C., with hydrochloric acid in a closed tube to 180°C. The constitution of ephedrine is $C^6H^5CH^2$ CH ($NHCH^3$) CH^2OH, and that of isoephedrine is $C^6H^5CH^2C$ (OH) (NH CH^3) CH^3.

The hydrochlorate of ephedrine forms acicular crystals which are freely soluble in water. Mr. J. G. Prebble (1889) found the twigs of *E. vulgaris* to contain 3 per cent. of a tannin, giving a whitish precipitate with gelatine and acetate of lead, and a greenish precipitate with acetate of iron.

CONIFERÆ.

JUNIPERUS COMMUNIS, *Linn.*

Fig.—*Richard. Conif.* 33, *t.* 5; *Reichb. Ic. Fl. Germ.*, *t.* 535. Juniper (*Eng.*), Genévrier (*Fr.*).

Hab.—Western Himalaya, Persia. The fruit.

Vernacular.—Hab-el-a'ra'r (*Ind. Bazars*).

History, Uses, &c.—A'ra'r (عرعر) is a Persian word; the author of the *Burhán* notices a popular belief that the Juniper is the enemy of the Date tree, and that the two will not grow together in the same place. Abu Hanifeh states on the authority of an Arab of the people of the Saráh, who are possessors of the *a'ra'r*, that it is the same as the Abhal (the latter name is applied in modern Arabic to the Juniper and Savine). He adds that he knew it in his own country, and afterwards saw it in the province of Kazween, cut for firewood from the mountains, in the neighbourhood of Ed-Deylem, and that the fruit is eaten when ripe. *J. communis* is a native of Greece, and must therefore have been known to the ancient Greeks, but there is much difficulty in identifying the two species of 'αρκευθὶς mentioned by Dioscorides. The fruit of some

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species of Juniper was, however, used by Hippocrates in certain disorders of the womb, and Dioscorides mentions its diuretic properties, its use in cough and pectoral affections, and also its digestive properties. The ashes of the bark were also applied locally in certain skin affections.

Ibn Sina closely follows Dioscorides and gives no additional information concerning the plant. The several kinds of Juniper growing on the Himalayas do not appear to be used medicinally by the Hindus, and the berries sold in the bazaars by Mahometan druggists are all imported from the west *viâ* Bombay.

In modern medicine Juniper is only used as a diuretic.

Description.—Juniper-berries are nearly globular, about ¼ inch in diameter, dark-purplish, and covered with a bluish-gray bloom; the short stalk at the base contains one or two whorls of the small scales, and the apex is marked by three radiating furrows, which are surrounded by ridges enclosing a triangular space. The three, or by abortion one or two, bony seeds are ovate in shape, triangular above, have six to ten large oil-sacs on their surface, and are imbedded in a brownish pulp which likewise contains oil-cells. The berries have an aromatic somewhat balsamic odour, and a sweet, terebinthinate, bitterish, and slightly acrid taste.

Chemical composition.—Juniper-berries were analysed by Trommsdorff (1822), Nicolet (1831), Steer (1856), and Donath (1873). They contain from ½ to 2½ per cent. of volatile oil, about ·30 per cent. of sugar, resins amounting to 10 per cent., 4 of protein compounds, fat, wax, formic and acetic acids, malates, and *juniperin*, which is light-yellow, slightly soluble in water, freely so in alcohol and ether, and with a golden-yellow colour in ammonia. Ritthausen (1877) obtained from juniper-berries, containing 10·77 per cent. of water, only 14·36 per cent. of sugar, 3·77 of ash, and 31·60 of cellulose.

Oil of juniper-berries is colourless or pale greenish-yellow, limpid, but on exposure rapidly thickens and turns yellow, and ultimately reddish-brown, at the same time acquiring an acid

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reaction; the fresh-distilled oil from old juniper-berries is thickish and light-yellow. Its specific gravity is about ·870, but varies between ·85 and ·90; it begins to boil at 155° C., or, if obtained from ripe berries, at 205° C. (Blanchet), has the peculiar odour of the berries and a warm, aromatic, somewhat sweetish and terebinthinate taste, shows a neutral reaction to test-paper, turns polarized light slightly to the left, and is slightly soluble in alcohol, forming with 10 or 12 parts of 80 per cent. alcohol or with 2 or 3 parts of officinal alcohol a more or less turbid solution; but it yields clear mixtures with carbon disulphide in all proportions. Iodine dissolves slowly in the limpid oil, but acts more energetically upon the thickened oil, sometimes producing fulmination; sulphuric acid colours it brown and red. Old oil of juniper contains formic acid, from which it may be freed by sodium carbonate and rectification.

The oil is a mixture of hydrocarbons of the general formula $C^{10} H^{16}$, which differ in their boiling-point, a portion boiling at 282°C. It yields with hydrochloric acid gas a liquid compound. (*Stillé and Maisch.*)

TAXUS BACCATA, *Linn.*

Fig.—*Wall. Tent. Fl. Nep., t.* 57; *Griff. Ic. Pl. Asiat.,* 376; *Bentl. and Trim., t.* 253. Yew (*Eng.*), If (*Fr.*).

Hab.—Temperate Himalaya. The leaves.

Vernacular.—Tálispatar (*Ind. Bazars*).

History, Uses, &c.—Under the name of Tálisa-pattra or Talipattra, Sanskrit medical writers describe a drug which has carminative, expectorant, stomachic, tonic and astringent properties, and is useful in phthisis, asthma, bronchitis, and vesical catarrh; the powdered leaves are given with the juice of *Adhatoaa Vasica* (vasaka) and honey in cough, asthma, and hæmoptysis. A confection called *Talisadya churna* is prepared with Talispattra, black pepper, long pepper, ginger, bamboo-

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manna, cardamoms, cinnamon, and sugar, and is used in the abovementioned diseases. The author of the *Burhán*, the oldest Persian Dictionary, which contains a large collection of Pahlavi words, mentions the same drug under the name of Tálisfar, and states that this name was applied by the Greeks to the leaf of the Indian Olive, or, according to some, to its root-bark. Ibn Sina speaks of it as an Indian bark, and describes its properties in the same manner as the Sanskrit writers; he states that Galen considers it to be possessed of hot and cold properties in equal proportion, but that others say it is hot and dry. Yahia bin Isa, the author of the *Minháj*, considers Talisfar to be the leaf of the Indian Olive; Ibn Baitar thinks that it is Mace. Haji Zein-el-attár identifies it with the μακερ of the Greeks, and says it is the root-bark of the Indian Olive, a bark thicker than China cinnamon and harder and of a darker colour, very astringent and slightly aromatic. The author of the *Makhzan-el-Adwiya* mentions the drug in two places, and identifies it incorrectly with the *Zarnab* of the Arabs; he also appears to confound it with *Hydrocotyle asiatica*. Speaking of Zarnab, he says, "it is also called *Rijl-el-jarád* (locust's foot). In Hindí it is *brahmi*, *barambhi* and *sapni*, and one kind of it is called *Manduparni* and *barahmi*, and the plant is called *Tális*, and the leaves, which are the same as Zarnab, are called *Tálispatr*. It is a plant with leaves broader than those of *Sátar-i-bari*, of a yellowish colour, and scented like a citron; the flower is yellow, and the plant is less than a cubit in height, with a quadrangular hollow stem; it has a pungent taste, and retains its properties four years. It grows in the hills of Fars, and is called *Sarv-i-Turkistáni;* it is also found in Hindustan and Bengal. * * * * It is hot and dry in the second degree, and has stimulant, astringent, stomachic, pectoral and digestive properties similar to cinnamon; the fresh juice is intoxicating; mixed with oil of roses or violets and introduced into the ear it cures cold headache. Substitutes, double the quantity of cinnamon, cubebs, cassia, or cardamoms.* * * *" Again, speaking of *Tálisfar*,* an article

* Under this name Royle obtained the leaves of Rhododendron lepidotum, which are highly aromatic. (*Antiq. of Hind. Med.*, p. 91.)

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described as one concerning the identity of which there is much difference of opinion, the author of the *Makhzan* says, "perhaps it is the same as Zarnab, which is called Túlis in Hindí, and which is the *narrow leaf of a tree of a dusty colour, externally and internally yellow.*" If we turn to the older Arabian writers, we find that we have no reason to identify Zarnab with Tálisapattra; they say that it is a certain perfume or certain sweet-smelling tree (*Kámús*), or a species of sweet-smelling plant (*Sihah*); it consists of slender round twigs, between the thickness of large needles and of writing reeds, black inclining to yellowness, not having much taste or odour, what odour it has, being of a fragrant kind like citron. (*Ibn Sína*, Book II.) According to the Turkish Kámús, it is the leaf of a sweet-smelling plant called رجل الجراد (locust's foot). Sprengel thought it was *Salix Ægyptiaca*. (Confer. *Hist. rei. herb.*, T. II., p. 270.) Zarnab is of the measure فعلل and is a genuine Arabic word. A rájiz says—

يا بابى انت و فوك الاشنب كانما ذر عليه الزرنب

"O with my father thou *shouldst be ransomed*, and thy mouth, that is cool and sweet, as though Zarnab were sprinkled upon it." (*Sihah.*)

In the tradition of Umm Zara, where it is said المس مس ارنب و الريح ريح زرنب "the feel is the feel of a hare, and the odour is the odour of Zarnab," Ibn el Athír, author of the *Nihayeh*, says that it signifies saffron (*Madd-el-kamús*). Ainslie (ii., 407) considers Tálispatar to be the leaves and twigs of *Flacourtia cataphracta*, Roxb. Dr. U. C. Dutt, in his Hindu Materia Medica, states that the Tálispatar of the Calcutta shops consists of the leaves and twigs of *Abies Webbiana*, Lindl.* Dr. Moidín Sheriff gives the name of Tálishapatri to the leaves of *Cinnamomum Tamala*, Nees. It would appear, therefore, that it is uncertain at the present time what the Tálisapattra of Sanskrit writers is, and that in different parts of the country various drugs are used as substitutes for it.

* Webb's or purple-coned fir.

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All the samples of the drug which we have obtained from Bengal, Northern, Western and Southern India have consisted of the leafy twigs of the yew chopped in lengths of from one to two inches.

The yew was known to the Greeks and Romans as a poisonous plant.* Modern enquiry has shown that the leaves and seeds are poisonous, but not the red pulp surrounding the latter. The leaves have, however, been recommended in doses of from 1 to 5 grains in epilepsy and other spasmodic affections. As an abortive they have been often administered, and have generally proved fatal to the woman, without causing the expulsion of the fœtus. Moderate doses given to animals occasion hurried breathing and palpitation of the heart, followed by recovery, and larger doses produce a similar effect followed by death from syncope. Very large doses appear to produce death by syncope without pain or spasm. According to Borcher's (1876) experiments, taxine reduces the pulse and respirations and causes convulsions, with fatal asphyxia. (Husemann.) After death the evidences of gastro-intestinal inflammation have generally been slight, the heart was usually empty, the kidneys strongly congested, and the blood less coagulated than usual. The effects produced upon man by poisonous doses of yew resemble those above mentioned as occurring in animals: after large doses the nervous irritation, exhaustion and gastric disturbance may be very trifling, the patient dying by syncope.

Description.—The drug consists of the small branches of the tree with their linear-lanceolate, narrow, rigid veinless leaves cut up into short length (1 to 2 inches). The male flowers are to be found upon some of the sprigs, and resemble those of the common yew. The wood of the larger stems is that of a yew, and not of a pine.

Chemical composition.—Statements have been made at different times as to the presence in the leaves and fruit of the yew (*Taxus baccata*) of an alkaloidal principle. In 1876 (*Pharm.*

* ταξος and σμιλαξ. Dios. 4, 80; Plin. 16, 20.

Journ., [3], vii., 894), Marmé described a crystalline alkaloid that he had separated from the leaves and fruit, which he named "*taxine*," and spoke of as being poisonous. It was obtained by treating an ethereal extract of the leaves and fruit with water acidulated with sulphuric acid and precipitating this solution with ammonia. Messrs. Hilger and Brande report (*Berichte*, xxiii., 464) that, working on the leaves in the same way, they have separated an alkaloid, which they failed to crystallize. This taxine melted at 82° C., and when heated in a glass tube gave off white fumes that condensed on the colder parts of the tube to oil-like drops that solidified on cooling, at the same time a characteristic aromatic odour was evolved. It dissolved in water in traces only, freely in alcohol and ether, with more difficulty in chloroform, and was insoluble in benzol. It was coloured intense purple-red by concentrated sulphuric acid and intense red-violet by Fröhde's reagent, and gave yellowish precipitates with the ordinary alkaloidal reagents, and white precipitates, insoluble in excess, with the fixed alkalies and ammonia. The salts of taxine are mostly readily soluble in water, but only the hydrochloride was obtained well crystallized, and this by passing a current of hydrochloric acid gas into a solution of the alkaloid in anhydrous ether. Analysis of taxine gave results corresponding with the formula $C^{37}H^{52}O^{10}N$, and its behaviour with ethyl iodide indicated that it is a nitrile base. The authors do not seem to have occupied themselves with the physiological action of taxine. (*Pharm. Journ.*, Mar. 29, 1890.)

Toxicology.—No cases of poisoning by this plant have been recorded in India, but considering its common use as a drug throughout the country, we cannot help suspecting that such accidents must have happened, especially as the native doctors do not appear to be aware of its poisonous properties. Several cases of poisoning by yew have occurred in England, most of which have ended fatally. The prominent symptoms were vomiting followed by narcotism, with, in some cases, convulsions and dilated pupils, respiration slowed; death usually by asphyxia, due to paralysis of the respiratory muscles.

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PINUS LONGIFOLIA, *Roxb.*

Fig.—*Royle Ill., t.* 85, *f.* 1; *Griff. Ic. Pl. Asiat., tt.* 369, 370.

Hab.—Outer Himalayan Ranges. The turpentine.

Vernacular.—Saral, Chir (*Hind.*). The turpentine, Ganda-biroja (*Ind. Bazars*).

History, Uses, &c.—The wood, in Sanskrit Sarala, and the turpentine Sarala-drava, are mentioned as medicinal in Sanskrit works; plasters, ointments, and pastiles for fumigations are directed to be made from the turpentine. The latter, under the name of Ganda-biroja, or, more correctly, Gandah-birozah, is found in all the Indian bazars, and appears to have all the properties of ordinary turpentine, though differing from it in odour. It is chiefly used as a pectoral plaster like the pitch plaster of Europe, but it has also a reputation in veterinary practice as a remedy for mange. The *Vaids* obtain from it by distillation without water a limpid sherry-coloured oil having the peculiar odour of the drug, which they call *Khanno oil* in the Deccan; it is in much repute as a remedy for gleet or long-standing gonorrhœa.

Collection.—The Chir Pine, which is a large tree of Afghanistan and the North-West Himalayas, is the chief source of this turpentine. Atkinson, who describes its collection in Gurhwal and Kumaon, says that it is there called *Birja* and *Lisha* or *Lassa,** and that there are two kinds collected, *viz.*, the *natural exudation* and *Bakhar-birja,*† which is obtained by making incisions in the sap-wood. The yield of a tree thus treated is said to be from 10 to 20 lbs. the first year, and about one-third the quantity the second year, after which the tree either dies or is blown down. (*Atkinson, Brandis.*)

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* लासा lásá; Illit. lásha; any viscous exudation of plants.

† बाखल, बाखर, or बखर an enclosure, house, chamber. An allusion to the small chamber cut in the tree to receive the turpentine.

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Description.—Gandah-birozah is a dirty-white opaque substance, of soft and sticky consistence, having a strong and peculiar odour, more aromatic than that of common turpentine; the leaves of some tree, which have evidently been used in collecting the turpentine, are usually found mixed with it in considerable quantity.

Chemical composition.—56 lbs. of the crude drug distilled with water yielded 8 lbs. of a colourless limpid oil, having the peculiar odour of Gandah-birozah. The resin remaining in the still was of a dull brown colour; after straining to remove impurities it was stirred with a small quantity of boiling water until hard, and afforded a very fair substitute for Burgundy Pitch, weighing 43 lbs.

The oil, according to Lyon, has a specific gravity of ·875 at 82° F.; it commences to boil at about 310° F., and is dextro-rotatory.

Pinus Khasyana, the Khasya Pine of Assam, yields a fine quality of turpentine. A full-grown tree gives as much as 68 lbs. of crude resin a year. The oil is very pure, and Dr. Armstrong in 1881, reported that it had the greatest amount of action on polarized light of any coniferous oil of turpentine he had examined.

Pinus Gerardiana, *Wall. Lamb. Pin. Ed.* 3, *t.* 79; *Royle Ill.* 353, *t.* 85, *f.* 2; *Cleghorn Pines of N.-W. Himal.*, *t.* 4, a native of Afghanistan and Persia, yields the pine-nuts which are sold in the Indian bazars under the name of *Chilghozeh,* and are described in Mohometan medical works under the Arabic name of *Hab-el-sanaubar-el-kibâr.* In Persia the tree is called *Sús* (سوس) and in Afghanistan *Chil* and *Zan-ghozeh.* Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia,* p. 152) states that the seeds are one of the great trade products exported from the district of Kost and the Kuram Valley to India; they have stimulating properties, and are considered useful in chronic rheumatic affections, and as an aphrodisiac. They are usually administered pounded with honey, in the form

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of a confection; they are of a brown colour, about one inch in length, and have an oleaginous and terebinthinate flavour.

Church, "Food Grains of India," found the percentage composition of the seeds to be Water 8·7, Albuminoids 13·6, Starch 22·5, Oil 51·3, Fibre 0·9, and Ash 3·0.

CEDRUS LIBANI, *Barrel.* var. *Deodara.*

Fig.—*Hook. f. Nat. Hist. Rev. ii., t.* 1-3; *Forbes, Pinet. Wob., t.* 48, 49; *Griff. Ic. Pl. Asiat., t.* 364.

Hab.—N.-W. Himalaya. The wood.

Vernacular.—Deodár-ki-lakri (*Ind. Bazars*).

History, Uses, &c.—This tree, in Sanskrit Devadáru, Suradáru, Suradruma "tree of the gods," yields the Bhadrakashtha "auspicious wood," Sneha-viddha "impregnated with oil," which is used as a carminative, diaphoretic, and diuretic by the Hindu physicians in fever, flatulence, inflammation, dropsy, urinary diseases, &c. It is chiefly used in combination with other medicines, as in the following diuretic mixture:—Take of Devadáru wood, root of *Moringa pterygosperma* (Sigru), and *Achyrantes aspera* (Apámárga), one drachm each and reduce to a paste with cow's urine. To be given in ascites. (Chakradatta.) The wood is also ground to a paste with water and applied to the temples to relieve headache. A tar (*Kilan-ka-tel*) made by destructive distillation of the wood is a favourite remedy for skin diseases in Northern India; it is given internally in doses of about one drachm, and also applied locally. From the Sanskrit name Devadáru of this wood, it must not be confounded with the wood of *Erythroxylon monogynum*, known in Tamil as Devadārum, and which, on account of its odour, is called "Bastard Sandal." *C. Libani* is the Deodár of Ibn Sina, who states that it is called *Sanúbar-el-hindi*, and is useful in rheumatism, piles, palsy, epilepsy, gravel in the kidneys or bladder and *prolapsus ani.* Háji Zein-el-Attár states that its juice is used in

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Harrún (Afghanistan) to tan leather (he doubtless alludes to the tar which is used in the Punjab to dress the inflated skins used for crossing rivers).

Description.—The wood sold in the bazars is of a light yellowish-brown colour, very heavy, and in thin sections translucent, owing to the large proportion of turpentine contained in it. It has an agreeable terebinthinate odour.

Preparation of the tar.—First, an earthen vessel (*ghara*), with a wide mouth, and capable of containing about 4 seers, is sunk in the ground. Next, a large *ghara* of about 12 seers' capacity is taken, and three small holes are drilled in its underside; it is then filled with scraps of the wood, and over its mouth another smaller jar is placed, and kept there by a luting of clay; and then both the jars are smeared over with a coating of clay. These two jars thus stuck together are next set on the mouth of the receiver sunk into the ground, and the joint is made tight by clay. Firewood is now heaped round the apparatus and lighted, and kept burning from four to eight hours. The jars are then separated and the tar removed. One seer (2 pounds) of wood yields about 2·6 chittaks ($5\frac{1}{2}$ ounces) of tar. (*Baden-Powell, Punjab Prod.*)

Chemical composition.—An alcoholic extract of the wood was spontaneously evaporated to dryness by exposure to air, and the extract agitated with petroleum ether, and the insoluble residue treated with caustic soda and agitated with ether

The petroleum ether extract on spontaneous evaporation left a transparent, pale yellow varnish-like residue, with a very fragrant terebinthinate odour, which became hard on exposure in thin layers, but preserved a perfect transparency. This extract was treated with aqueous caustic potash and agitated with ether. The mixture after standing separated into three layers. The lowest stratum was of a reddish yellow colour, the middle darker in colour, and the small amount which floated above the ether of a bright light yellow tint. The ethereal layer on spontaneous evaporation, left a satiny mass of fragrant odour, which, on microscopic examination, consisted of interlaced

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needles and narrow plates. On ignition an alkaline ash was left. In sulphuric acid it dissolved with a yellow colour, no change being induced by the addition of nitric acid to the solution or hydrochloric acid and phenol. In order to obtain this resin acid in a free state, an ethereal solution of the potash salt was agitated with dilute sulphuric acid. On spontaneous evaporation of the ether, the acid was left as a transparent varnish.

The middle layer mentioned above appeared to consist of a concentrated solution of the potash salt of the resin acid; the potash salt not being very readily soluble in ether. The aqueous stratum was treated with sulphuric acid and agitated with ether, the ethereal extract was yellow, and had a slight odour not unlike that of valeric acid.

That portion of the original alcoholic extract insoluble in petroleum ether, was now agitated with ether and aqueous potash. The ether left on spontaneous evaporation a transparent yellow extract, insoluble in water; soluble in alcohol with neutral reaction, and possessing a marked bitter taste. Sulphuric acid coloured the extract a bistre-red. The potash solution was mixed with sulphuric acid and agitated with ether; during agitation dark reddish flocks separated, which were insoluble in ether even after prolonged agitation. The ethereal solution left a yellow transparent residue. In alcohol the extract was soluble with bitter taste and acid reaction. In concentrated sulphuric acid it dissolved with a dark-red colour, the addition of concentrated hydrochloric acid afforded a colour of crushed strawberries, which became of a reddish violet on the addition of phenol. In aqueous potash the extract dissolved with a bright yellow coloration. Ferric chloride added to an alcoholic solution gave a dirty brown coloration. The flocks insoluble in ether were of a reddish-brown colour, brittle when dry, without bitterness in an alcoholic solution, acid in reaction, and affording similar reactions with sulphuric and hydrochloric acids and phenol, and ferric chloride and caustic potash, to the resin soluble in ether.

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CYCADACEÆ.

CYCAS CIRCINALIS, *Linn.*

Fig.—*Richard, Conif., t.* 24—26; *Bot. Mag., t.* 2826 and 2827; *Rheede, Hort. Mal. iii.,* 9, *t.* 13—21.

Hab.—Malabar Coast, Dry Hills in W. Madras. Male bracts and flour.

Vernacular.—Jungli-madan-mast-ka-phul (*Hind.*), Madana-kama-pu, Kamappu, Chanang kay (*Tam.*), Rinbadam, Todda-pana Eentha kay (*Mal.*), Malabári-supari (*Mar.*).

History, Uses, &c.—The male bracts of this tree are used in Southern India as a narcotic, and are considered to be similar in medicinal action to the flowers of *Stereospermum suaveolens.* Both drugs are termed Madana-kama-pu or flowers of Kama, and are said to contain a property that intoxicates insects that rest upon them. The bracts are powdered up with other substances and made into a confection as an aphrodisiac. Flour is made from this tree both from the stem and the nuts. In Malabar the nuts are collected and dried for a month in the sun, beaten in a mortar, and the kernels form a flour which is called *Indum Podi.* It is reckoned superior to the flour of Caryota, but inferior to rice, and is only eaten by the hill-tribes, and by the poorer classes, who, from July to September, when rice is scarce, are in danger of perishing. It has often been confounded with true sago. Rheede states that the fruit bearing cone reduced to a poultice and applied to the loins removes nephritic pains.

Description.—The bracts as sold in the bazar are of the shape of a spear head, two inches long by half an inch broad, clothed at the back with much fulvous down. A subulate incurved point rises from the exterior upper angle of each of the scales. When the strobile first appears, they are closely pressed together like the germs in the pineapple, but as it lengthens by age, they become detached from each other. Filaments none; the anthers entirely covering the under surface

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of the scales, one-celled, two-valved, opening round the apex on discharging the pollen. The starch of the pith resembles that of sago under the microscope.

Chemical composition.—The bracts or scales contain, in a dried state, much albuminous and mucilaginous matter soluble in water, but no alkaloid or other principle that would account for its reputed narcotic action.

ORCHIDEÆ.

ORCHIS LATIFOLIA, *Linn.*

Fig.—*Fl. Br.* 924; *Engl. Bot.* 33., *t.* 2308; *Reichb. Fl. Germ. xiii., t.* 50. Marsh Palmate Orchis (*Eng.*).

Hab.—Persia, Afghanistan, Nepal, Cashmere, and Europe.

ORCHIS LAXIFLORA, *Lam.*

Fig.—? *Boiss. Fl. Orient. v.*, p. 71.

Hab.—Persia and Afghanistan. The tubers.

Vernacular.—Salab-misri, Salap-misri (*Hind.*), Shálá-mishiri (*Tam.*), Sálá-misiri (*Tel.*), Sálá-mishri (*Mal.*), Chále-michhri (*Beng.*), Sálama-misri (*Mar.*, *Guz.*).

History, Uses, &c.—Theophrastus (P. H. ix., 19), and Dioscorides (iii., 132, 133, 134, 135), mention several tuberous roots which were used by the Greeks under the names of Orchis or Serapias and Satyrion. It is not known exactly what all of these were, but it is certain that some of them were the tubers of different species of Orchis. Ορχις is described by the ancients as having a twofold root, formed of tuberosities which resemble the testes in appearance. The larger of these tuberosities, or, as some say, the harder of the two, taken in water, was thought to be provocative of lust; while the smaller, or, according to some, the softer one, taken in goat's milk, was considered to be

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antaphrodisiac. The tubers were also used as a remedy for ulcerations of the mouth and pituitous discharges from the chest, and were taken in wine as an astringent.

Mahometan physicians describe Orchis tubers under the name of Khusyu-uth-thalab (or salab), "foxes' testicles," and state that the odour of them, when fresh, resembles that of *semen hominis*, and that they have an aphrodisiac effect if clasped in the hand. The dried tubers have a great reputation in the East as a nervine tonic and restorative, and are much prescribed in paralytic affections. It was formerly supposed that Oriental Salep was obtained from certain species of Eulophia, but the tubers of these plants have no resemblance to the commercial article, and Aitchison has now established the fact that the two plants placed at the head of this article yield the bulk of the Persian salep. *Eulophia campestris*, Wall., is, however, used locally in Northern India as a substitute for salep.

In Southern India the tubers of several species of Habenaria and Orchis are collected by people in the hilly districts and sold locally as salep, but they are usually small and variable in appearance.

Salep is now regarded in Europe as very nutritious; it tends to confine the bowels, and is, therefore, a useful article of diet for those who suffer from diarrhœa.

The mucilage is prepared by first macerating powdered salep in cold water, and gradually adding boiling water, with stirring, in the proportion of 5 grains of salep to the ounce. Instead of water, milk or some animal broth may be used. Salep jelly may be made as follows: Rub 60 grains of powdered salep with water in a mortar until it has swollen to four times its original bulk; then add gradually, and with constant stirring, 16 ounces of boiling water, and boil down to 8 ounces.

Ainslie states that salep has the property of depriving salt-water of its salt taste.

Description.—Oriental salep is of two kinds, palmate and ovoid; the former, which was once known in Europe as *Radix palmæ Christi*, is very highly esteemed by the Persians,

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especially if of large size. The ovoid tubers are from 1 to 1½ inches in length, and, if of good quality, have a creamy white colour, or are somewhat translucent and of a horny texture. They have hardly any odour and an insipid mucilaginous taste. The tubers should be plump and not wrinkled. When magnified, the bulk of the tuber is seen to consist of a parenchyme, the cells of which contain either mucilage, or starch altered by heat; it is traversed by small fibro-vascular bundles.

Chemical composition.—The most important constituent of salep is a sort of mucilage, the proportion of which, according to Dragendorff (1865), amounts to 48 per cent.; but it is, doubtless, subject to great variation. Salep yields this mucilage to cold water, forming a solution which is turned blue by iodine, and mixes clearly with neutral acetate of lead like gum arabic. On addition of ammonia, an abundant precipitate is formed. Mucilage of salep precipitated by alcohol and then dried, is coloured violet or blue, if moistened with a solution of iodine in iodide of potassium. The dry mucilage is readily soluble in ammoniacal solution of oxide of copper; when boiled with nitric acid, oxalic, but not mucic, acid is produced. In these two respects, the mucilage of salep agrees with cellulose, rather than with gum arabic. In the large cells in which it is contained, it does not exhibit any stratification, so that its formation does not appear due to a metamorphosis of the cell-wall itself. Mucilage of salep contains some nitrogen and inorganic matter, of which it is with difficulty deprived by repeated precipitation by alcohol.

It is to the mucilage just described that salep chiefly owes its power of forming with even 40 parts of water a thick jelly, which becomes still thicker on addition of magnesia or borax. The starch, however, assists in the formation of this jelly; yet its amount is very small, or even *nil* in the tuber bearing the flowering stem, whereas the young lateral tuber abounds in it. The starch so deposited is evidently consumed in the subsequent period of vegetation, thus explaining the fact that tubers are found the decoction of which is not rendered blue by iodine. Salep contains also sugar and albumin, and, when fresh, a trace of volatile oil. Dried at 110° C., it yields 2 per cent. of ash,

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consisting chiefly of phosphates and chlorides of potassium and calcium. (*Pharmacographia.*) Gans and Tollens have tested the oxidation products, and in *Annales*, **249**, 245 (*J. Chem. Soc.*, May 1889), they report : "On oxidation salep yields saccharic acid, but no mucic acid. No furfuraldehyde is obtained by distilling salep syrup with dilute acids. With phenylhydrazine and sodium acetate it forms a precipitate which can be separated by crystallization from the phenylhydrazine compounds of dextrose and mannose, results which show that the syrup contains dextrose and mannose, but neither galactose nor arabinose."

Commerce.—In Eastern markets salep is classed as palmate and non-palmate. The former kind only appears in small quantities, and is much more highly valued than the latter; in Persia it is called *Panjeh-i-sálab*, or "hand salab," a name which is corrupted into *Punjábi* in India. The ordinary salep of commerce is known as *Abushaheri* or *lasaniya*, "garlic-like"; it sells at Rs. 30 to 35 per maund of 41 lbs., according to quality, whilst the palmate variety fetches fancy prices; if very fine and white, from 5 to 10 rupees per lb. may be asked for it.

The salep of Madras is largely supplied from the Nilgiris, where it is collected by the Todas and other hill tribes. The tubers are boiled in water, and then dried in the sun until quite hard, and are sent into the market in coarse bags containing five maunds. In Ootacamund this salep sells for Rs. 5 to Rs. 6 a maund of 25 lbs., and in Madras it realizes about twice the price. Mahomedans all over Southern India use this salep for making conjees and the sweetmeat *hulwa*.

Imitation salep is largely manufactured in India; it is known as *Banawati salab* or *salam*, and is said to be made of pounded potatoes and gum.

EULOPHIA VIRENS, *Br.*

Fig.—*Bot. Reg.*, *t.* 573; *Wight Ic.*, *t.* 913; *Bot. Mag.*, *t.* 5579; *Roxb. Cor. Pl. i.*, *t.* 38; *Rheede, Hort. Mal. xii.*, *tt.* 25, 26.

Hab.—Bengal and Deccan Peninsula.

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EULOPHIA CAMPESTRIS, *Wall.*

Hab.—Plains of India, Punjab, Oudh, Bengal, and Deccan.

EULOPHIA NUDA, *Lindl.*

Fig.—*Wight Ic.*, *t.* 1690; *Rheede, Hort. Mal. xii.*, *t.* 26?

Hab.—Tropical Himalaya and Deccan Peninsula. The tubers.

Vernacular.— Mán-kand, Amber-kand, Bhui-kákali (*Mar.*), Katou-kaida-maravara, Katou-theka-maravara (*Mal.*), Budbar, (*Beng.*), Goruma (*Hind.*).

History, Uses, &c.—The tubers of these plants are used indiscriminately by the natives. The vernacular name *Mán-kand* is derived from the Sanskrit *Manya*, which signifies "the neck," and the plant is so named from a supposed resemblance between its tubers and scrofulous glands in the neck; Mán (मान), the Marathi form of the word, is also applied to the scrofulous disease in the neck. The tubers are applied externally and given internally to remove the disease. They are also administered internally to those suffering from intestinal worms. Rheede says of *E. virens*:—"Succus radicis si supra arborem *Kansjira* inveniatur amarus est, alvum laxat, bilem promovet. Succus bulbi et foliorum omnem adustionem ex pulvere pyrio, oleo ferventi, vel igne causatam, cum sanguine canino mixtus, tollit. Pulvis venenum, sive externum sive internum expellit. Si supra arborem *Java*, vermes intestinorum enecat, febri resistit, ventriculum corroborat, flatus dissipit. Succus cum carne totius plantæ in formam cataplasmatis redactus apostemata emollit, et, sine dolore, ad maturitatem producit." Roxburgh describes *E. virens* under the name of *Limodorum virens*, but does not notice its medicinal uses. Aitchison (*Notes on Products of W. Afghanistan and N. E. Persia*, p. 68) says:—"*E. campestris* is by no means rare in the Punjab, Baluchistan, and Afghanistan. Its tubers are collected in the Punjab, and make up the ordinary Salep of Lahore. When the present railway bridge was being constructed over the Chenab, at Wazirabad,

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some of the islands over which the bridge was built were one season covered with this Orchis, specimens of which were sent to me by Captain Clerk, and which are now in the Herbarium at Kew." A parcel of the tubers of *E. campestris* was sent to one of us from the Native State of Sirohi, with the object of ascertaining their commercial value if collected as Salep; they were similar in form to those of *E. nuda*, but smaller, and bore no resemblance to the commercial article.

Description.—The tubers of *E. virens* are conico-obpyriform, surrounded with circular marks showing the insertions of old leaves; if they have been exposed to the air, as is often the case with the upper portion of the tuber, they are of a greenish colour, when not so exposed of a yellowish white. In the fresh state many fleshy fibres issue from the lower portion of the tuber. *E. nuda* has larger tubers, often much flattened, in structure and colour they resemble those of *E. virens*, the leaves are larger, and the flowers often purple, though in some specimens they are green like those of *E. virens*. The tubers of *E. campestris* are of a similar character. Under the microscope the gum cells are seen, and the exterior cells contain bundles of raphides. The small tubers exhibit starch granules, but in large tubers these are entirely absent.

Chemical composition.—The fresh tubers contain a large quantity of clear white mucilage, which is not precipitated by ferric chloride or neutral acetate of lead, but is precipitated by basic acetate of lead and alcohol. The mucilage, unlike that of salep, is not coloured violet by iodine solution. Nitric acid forms no mucic acid when allowed to act upon the gum. The ash of the dried tubers amounted to 3·6 per cent.

DENDROBIUM MACRAEI, *Lindl.*

Fig.—*Xen. Orchid. ii., t.* 118.

Hab.—Sikkim, Khasia Mts., The Concan, and Nilgiri Hills. The plant.

Vernacular.—Jivanti, Jiba-ság (*Hind.*), Jibai, Jibanti (*Beng.*), Jivanti (*Mar.*, *Guz.*).

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History, Uses, &c.—This plant is the Jivanti of Sanskrit writers. In the Nighantás it bears the synonyms of Jivani, Jiva "life-giving," Jivaníyá "supporting life," Jiva-sreshtha, Sáka-sreshtha "best of herbs," and Yasas-vini "renowned." It is also spoken of as Jiva-bhadra and Mangalya "auspicious," and is described as cold, mucilaginous, light, strengthening, and *tridosha-ghna*, *i.e.*, a remedy for the disorder of the three humors of the body, bile, blood and phlegm, known to Hindu physicians as *tridosha*. The whole plant is used in decoction along with other drugs supposed to have similar properties; it must not be confounded with *Jivaka*, one of the *Ashtavarga*, which is a drug unknown to the modern Hindus. *D. Macraei* does not appear to have been noticed by any of the European writers upon Indian Materia Medica.

Description.—A much-branched plant, often found on Jambul trees; stems long and pendulous, knotty, and with many oblong pseudo-bulbs; leaf one, terminal, shortly oblong, on the terminating pseudo-bulb, four to eight inches long, sessile; flowers white, side lobes of lip sprinkled with red, solitary at the base of the leaf, one in front and one behind; middle lobe of the lip much dilated, and the disk with two longitudinal fleshy crests. This plant has from its coloration been well named *pardalinum* or panther-like by Reichberg.

Chemical composition.—The alcoholic extract of the dried roots and stems was mixed with water acidulated with sulphuric acid and agitated with petroleum ether, ether, and then rendered alkaline and reagitated with ether. The petroleum ether extract had an aromatic odour, and was of a yellow colour and soft consistence. In cold absolute alcohol the greater part dissolved with acid reaction; the insoluble residue was white, and had the characters of a wax. During agitation with petroleum ether, chocolate flocks separated.

The acid ether extract formed a waxy, transparent red varnish, which repelled water, and was insoluble in it. In absolute alcohol the extract dissolved with strong acid reaction. The extract was treated with caustic soda and agitated with

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ether. The ether extract formed a yellow varnish indistinctly crystalline in places. By the action of acidulated water traces of an alkaloid were separated. The extract when acted upon by cold absolute alcohol afforded a bright yellow solution without bitter taste; the portion of the extract insoluble in cold alcohol was white, by heating with alcohol it dissolved, and on cooling white woolly flocks separated, which on microscopic examination presented the appearance of interlaced hair-like masses. The amount of this principle was very small and its nature could not be determined. The alkaline solution of the original ether extract was acidulated and reagitated with ether, which left on separation a red transparent waxy varnish, insoluble in water, easily soluble in cold absolute alcohol with strong acid reaction and bitter taste. This principle had the properties of a resin acid, and we propose terming it *β Jibantic acid*. The alkaline ether extract contained traces of a white alkaloid without bitterness, crystallizable from ether, and giving a faint yellow coloration with Fröhde's reagent in the cold, deepening slightly on warming; no reaction with nitric acid. We provisionally call this alkaloid *Jibantine*. This alkaloid appeared similar to the one contained in the acid ether extract.

The chocolate-coloured flakes referred to as having separated on agitation with petroleum ether, were repeatedly agitated with ether, which on evaporation afforded a small amount of extractive similar to the original acid ether extract. The insoluble flocks were then dissolved in caustic soda and reagitated with ether, the ether affording a small amount of extractive. The alkaline solution was rendered acid and reagitated with ether, which separated a certain amount of a bitter acid resin, similar to the one we have termed β Jibantic acid, while chocolate flocks remained insoluble.

β Jibantic acid when freshly precipitated from an alkaline solution by acids would appear to be easily soluble in ether, but the flocks after standing become less soluble. The chocolate flocks just referred to were repeatedly agitated with ether, dissolved in caustic soda, precipitated with acid, and reagitated

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with ether, in order to separate β Jibantic acid. Finally the flocks insoluble in ether were dissolved in alcohol, which afforded a red solution with only sight bitterness. We provisionally call this acid α *Jibantic acid.*

The chief points of difference and resemblance between these two acids may be summarized thus—bitterness, and easy solubility of the β acid, when freshly precipitated, in ether: slight bitterness and insolubility of the α acid, when freshly precipitated, in ether. The β acid is precipitated in lighter coloured flocks from an alkaline solution than the α acid. Both acids are soluble with equal readiness in alkalies and cold absolute alcohol.

VANDA ROXBURGHII, *Br.*

Fig.—*Bot. Reg.*, *t.* 506; *Wight Ic.*, *t.* 916; *Fl. des Serres*, ii., *t.* 11; *Reichb. Fl. Exot.*, *t.* 121.

Hab.—Bengal, Behar, Guzerat, Concan to Travancore. The roots.

SACCOLABIUM PAPILLOSUM, *Lindl.*

Fig.—*Bot. Reg.*, *t.* 1552.

Hab.—Bengal and the Lower Himalaya, Assam, the Gangetic Delta, the Circars and Tenasserim. The roots.

Vernacular.—Rásna (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. ii, p. 260) that we consider it probable that the original Rásna of the Arians was *Inula Helenium*, as the two drugs at the head of this article are notably deficient in the properties ascribed to Rásna by Sanskrit writers; for instance, the plants under consideration cannot be described as Gandha-mula "having a strong smelling root." Dutt (*Mat. Med.*, p. 258) remarks:—"Under the name of *rásna*, the roots of *Vanda Roxburghii* and *Acampe papillosa* are both indiscriminately used by native physicians. They are very similar in the appearance of their roots and leaves, though they differ much in their flowers and

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fruit. One native physician whom I consulted, pronounced both of these plants to be *rásna*; when, however, I showed him the different flowers and fruit of the two species, he was puzzled." The description of the properties and uses of rásna will, we think, convince our readers that the original drug was not what is now used.

Rásna is said to be bitter and fragrant, and useful in rheumatism; the *Rásnapanchaka* is a decoction of *rásna; Tinospora cordifolia*, wood of *Cedrus Deodara*, Ginger, and root of *Ricinus communis*, of each equal parts; it is a popular prescription for rheumatism. *Rásna guggulu* is a *ghrita* composed of eight parts of *rásna* and ten of bdellium beaten into a uniform mass with clarified butter; it is given in drachm doses in sciatica. *Rásna* is also an ingredient of several oils used for external application in rheumatism and neuralgia, such as *Mahámásha taila, Madhyama Naráyana taila, &c.* *Vanda* is a general name in Sanskrit and the vernaculars for parasitic plants; other Sanskrit names for these plants are *Vrikshádani* and *Vriksharuha* "growing on trees." They are further distinguished by the addition of the names of the tree on which they grow, thus *Amara-vanda* would signify the *Vanda* of the *Amara* or mango.

Description.—*V. Roxburghii.*—Stem climbing, 1—2 feet; leaves 6 to 8 inches long, præmorse, narrow, complicate; peduncle 6 to 8 inches, 6 to 10-fid; sepals and petals yellowish-green or bluish, except from the clathrate-brown nerves, margins white, lip half as long as the sepals or more, disk of mid-lobe convex with fleshy ridges and white margins and mesial lines, spur conical.

S. papillosum.—Stem climbing, 2 to 3 feet; leaves 3 to 4 inches long, obliquely notched, narrow, complicate; scape 1 to 2 inches, closely scarred at the base, internodes close, bracts semicircular; flowers $\frac{3}{4}$ of an inch in diameter, mid-lobe of lip ovate, spur conical, pubescent within, petals yellow marked with red lines, lip white.

In the Concan *S. Wightianum*, Hook. f., *Rheede, Hort. Mal.* xii., *t.* 4, and *S. præmorsum*, Hook. f. *Rheede, Hort. Mal.* xii.,

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t. 4, very similar plants, are used as Rásna. The Marathi peasants call these plants *Kánbher.*

Ordinary bazar Rásna both in Calcutta and Bombay consists of long branching roots, having something the appearance of sarsaparilla, but of a dark greyish-brown colour. The bark is thin and marked by numerous longitudinal furrows, the substance of the root light-brown and very fibrous; a transverse section shows the woody portion to be arranged in wedge-shaped bundles. The root is inodorous, and has a starchy bitterish and astringent taste.

In Bombay a second kind of Rásna is sold at a much higher price, which bears no resemblance to the ordinary commercial article; it occurs as straight pieces of a root about the size of a crowquill at the thickest part, gradually tapering to a point, and tied up in small bundles with thread. This root is of a light brown colour, with a thick and very hard bark; it has a faint peculiar odour when powdered, which recalls that of ipecacuanha. It is called *Khadaki-rasna* in Bombay. Under this name we have also received the roots of *Tylophora asthmatica.*

Chemical composition.—The standard *Rásna* of the Indian bazars yielded the following principles when an alcoholic extract of the whole dried plant was treated in a similar manner to that described under *Jibanti* p. 390: α—resin acid of a chocolate colour, insoluble in petroleum ether and ether: β—resin acid soluble in ether: neutral yellow resin: an alkaloidal principle: a white neutral principle: a neutral fluorescing principle. In physical and chemical properties the first five principles were similar to those described under *Jibanti.* An examination of the more expensive *Rásna* of the Bombay market gave the following results :—

A tincture prepared with 80 per cent. alcohol, gelatinized on concentration, after separation of the whole of the alcohol, the extract was agitated with amylic alcohol, and water acidulated with acetic acid. Amylic alcohol was selected for the first extraction, because preliminary experiments indicated that when petroleum ether or ether was used for agitation with an

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aqueous solution of the alcoholic extract, the liquid formed an emulsion which showed little or no tendency to separate. The amylic alcohol tincture was evaporated on a water bath, and, when dry, was repeatedly agitated with ether, until colouring matter ceased to be dissolved. The extract insoluble in ether was then redissolved in amylic alcohol and agitated repeatedly with baryta water, until the baryta water ceased to be colored yellow. During agitation a soft varnish-like mass separated and adhered to the sides of the bottle. By this treatment the original amylic alcohol extract was separated into three fractions: (1) The amylic alcohol solution, (2) the varnish-like residue adhering to the sides of the bottle, and (3) the baryta water solution.

(1) The amylic alcohol solution on evaporation left a solid residue, which, after being pounded, and agitated with ether, to remove traces of adherent amylic alcohol, possessed the properties of a saponin-like principle; it frothed considerably with water; treated with concentrated sulphuric acid, a dirty reddish coloration was slowly developed; in water and aqueous ammonia it was only slightly soluble, but dissolved easily in ordinary acetic acid. As extracted the principle was not pure, it contained colouring matter and barium.

(2) The varnish-like residue was dissolved in acetic acid and agitated with amylic alcohol, the extract being treated with ether to remove traces of amylic alcohol. This extract also behaved like a saponin-like principle: after purification it formed a yellowish powder, it frothed considerably with water; treated with concentrated sulphuric acid, it developed in a shorter period than the first extract a beautiful bright carmine coloration: in water it was easily soluble, a concentrated solution having much the physical appearance of an aqueous egg albumen, and it dissolved readily in aqueous ammonia.

(3) The baryta water solution contained much colouring matter and a small amount of a principle which frothed with water, which was probably a mixture of the two principles already mentioned.

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The original aqueous solution of the alcoholic extract left after agitation with amylic alcohol was acidulated with acetic acid and agitated with ether. The ether extract contained a neutral resin-like principle, a very bitter resin acid, the bitter taste of the drug being probably due to this resin, and a white crystallizable acid.

Finally, the acid aqueous solution was treated with sodic carbonate in excess and reagitated with ether. The ether separated traces of an alkaloidal principle, which afforded a faint yellow coloration with Fröhde's reagent, deeping slightly on heating.

Vanda spathulata, *Spreng.*, is the *Ponnampou-mara-rara* of Rheede (12, 3), and is supposed on the Malabar Coast to temper the bile and abate phrenzy, and the golden yellow flowers, reduced to powder, are given in consumption, asthma, and mania. (See Ainslie, *Mat. Med.*, ii., 321.)

Rhynchostylis retusa, *Blume*, is also mentioned by Rheede (xii., 1), also **Cymbidium tenuifolium** (xii., 5 and 6) and *C. ovatum* (xii., 7), as emollients. **C. aloifolium** (xii., 8) is said to be emetic and purgative.

SCITAMINEÆ.

CURCUMA AROMATICA, *Salisb.*

Fig.—*Salisb. Parad.*, *t.* 96; *Rosc. Scit.*, *t.* 103; *Wight Ic.*, *t.* 2005; *Bot. Mag.*, *t.* 1546. Wild Turmeric, Yellow Zedoary, Cochin Turmeric (*Eng.*), Zedoaire jaune (*Fr.*).

Hab.—Throughout India, wild and cultivated. The tubers.

Vernacular.—Jangli-haldi, Ban-haldi (*Hind.*), Ban-halad (*Beng.*), Rán-halad, Vedi-halad (*Mar.*), Amba-halad (*Guz.*), Kashturi-manjal (*Tam.*), Kasturi-pasupa, Kattu-mannal (*Tel.*), Kasturi-arishina, Kad-arishina (*Can.*).

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History, Uses, &c.—This plant is the Vana-haridra or "wild turmeric" of Sanskrit writers. The Arabian and Persian physicians do not notice it, and probably did not distinguish it from turmeric. Roxburgh and Ainslie wrongly supposed it to be the Jadwar of the Arabians (see Vol. I., p. 20). It is the turmeric-coloured zedoary of Ainslie, who states that the Mahometans of Southern India suppose it to be a valuable medicine in snake-bite, administered in conjunction with golden orpiment, costus, and ajwain seeds. Guibourt (ii., p. 214) calls it *Zedoaire jaune,* and states that the plant which produces it has been well described and figured by Rumphius, and is his *Tommon-bezaar* or *Tommon primum,* which has been wrongly referred by most writers to the *Curcuma Zedoaria* of Roscoe. *C. Aromatica* is identical with the Cassumunar described by Pereira (*Mat. Med.*, Vol. II., Pt. I., p. 236), and the "Cochin Turmeric" noticed by Flückiger and Hanbury (*Pharmacographia*, p. 580). The properties of this drug are very similar to those of turmeric, but its flavour being strongly camphoraceous is not so agreeable. It is used medicinally by the Hindus, in combination with other drugs, as an external application to bruises, sprains, &c., and is applied to promote the eruption in the exanthematous fevers; it is seldom used alone, but is combined with astringents when applied to bruises, and with bitters and aromatics to promote eruptions; it is never used as a condiment in India, but a kind of arrowroot is prepared from the tubers in Travancore. The plant under favourable circumstances produces central tubers as large as a small turnip. One of us has had it under cultivation for some years; the leaves when young have a central purple stain, which almost disappears when they attain their full size. The flowers appear in May or June, with the first leaves, just before the the rainy season.

Description.—Central rhizome oblong or conical, often more than two inches in diameter, external surface dark-grey, marked with circular rings and giving off many thick rootlets; at the ends of some of them are orange-yellow tubers about the size and shape of an almond in its shell; lateral rhizomes about

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as thick as the finger, with a few fleshy rootlets. Internally both central and lateral rhizomes are of a deep orange colour like turmeric; the odour of the root is strongly camphoraceous.

Microscopic structure.—Similar to that of turmeric.

Chemical composition.—The drug yielded to analysis:—

Ether extract (essential oil, fat, and soft resins)...	12·06
Alcoholic extract (sugar, resins)	1·14
Water extract (gum, acids, &c).	6·50
Starch	23·46
Crude fibre	8·42
Ash	4·46
Moisture	13·33
Albuminoids, modifications of arabin, &c.	30·63
	100·00

The root had an odour of ginger; curcumin was present. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid.

Commerce.—The plant is chiefly grown at Alwaye, North-east of Cochin, and is also collected in Mysore, Wynaad, and other localities in Southern India for export to Europe as a substitute for turmeric to be used in dyeing. It is exported from Cochin and Bombay. Value, Rs. 24 to 25 per candy of 5¼ cwts. for the unpeeled root, Rs. 27 to 28 when peeled.

A European firm of Druggists in Bombay, writing to London for the ingredients to make Warburgh's fever tincture, was supplied with this article as Zedoary.

Exports of Turmeric from Cochin:—

	Europe, &c.	India, Burma, &c.	Total cwts.
1884-85	5,154	6,361	11,515
1885-86	7,610	2,776	10,386
1886-87	6,031	1,967	7,998
1887-88	2,356	2,039	4,395
1888-89	459	1,817	2,276
1889-90	2,013	6,704	8,717

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CURCUMA ZEDOARIA, *Rosc.*

Fig.— *Rosc. Scit., t.* 109; *Roxb. Cor. Pl., t.* 101; *Rheede, Hort. Mal. xi., t.* 7. Zedoary (*Eng.*), Zedoaire (*Fr.*).

Hab.—Eastern Himalaya, cultivated throughout India. The tubers.

Vernacular.—Kachúra (*Hind., Beng., Mar., Can., Guz.*), Kichilick-kizhanghu, Pulan-kizhanga (*Tam.*), Kichili-gaddala, Kachoram (*Tel.*), Kacholam, Kachuri-kizhanna, Pula-kizhanna (*Mal.*).

History, Uses, &c.—This plant is the Sati and Krachura of Sanskrit writers, and the Zerumbád and Urúk-el-káfúr, "camphor root," of the Arabians. It is noticed by the later Greek physicians under the name ζουρομβέδ, a corruption of the Arabic name, which, in the Middle Ages, was variously written as Zeruban, Zerumber, and Zerumbet. It is not the ζέδοαρ of Ætius (A. D. 540—550) or the τζετόυαριον of Myrepsus, or the Zedoar of Macer Floridus (A. D. 1140). Barbosa (1516) speaks of *Zedoaria* and *Zeruban* as distinct articles of trade at Cannanore, so that it must have been some time after this date that Zerumbet came into use in Europe as a cheap substitute for the Zedoar of the earlier physicians, which, we have no doubt, was the same drug as the Jadwar of the Arabians. This name, correctly written by Ætius, is the ژد وار (Zhedwar) of the ancient Persians, and is described in the *Burhán* (A. D. 1046) as a drug used as an antidote to poisons, the same as the Jadwár of the Arabians, and also called *Mahparvin*. Ibn Sina of Bokhara, who lived about the same time (980—1037), describes Jadwár shortly in the following words:—
الماهية قطع يشبه الزرا وند و ادق منه —"it has the form of the root of Aristolochia, but is smaller." Haji-Zein-el-attár, the well-known Persian physician and apothecary, and the author of the "Ikhtiarát" (A. D. 1368), describes Jadwár as a root about the size and shape of the Indian Cyperus root, but harder and heavier, and the same as the Indian drug Nirbisi, the best internally of a purplish tint. He states that there

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are, as far as his experience goes, four drugs sold as Jadwár, viz., a white kind, a purplish, a black and a yellow ; the people of Cathay call the yellow kind *Kurti* and the purplish *Burbi*, the other two kinds come from India. As to the locality in which the drug is collected, he states that there is a mountain called Farájal between India and Cathay, where the plant grows along with the aconite, and that the latter, whenever it grows near the Jadwár, loses its poisonous properties and is eaten with impunity by the inhabitants. Where the Jadwár does not grow, the aconite (Bish) is a deadly poison, and is called *Halúhal* by the natives (Halahala, Sanskrit). In the *Dict. Econ. Prod. of India* (ii., p. 656), the following interesting account of certain drugs collected in Nepal by Dr. Gimlette, the Residency Surgeon, substantially confirms Haji-Zein's description of Jadwár or Nirbisi:—According to Dr. Gimlette, "the *Kala bikh* of the Nepalese (the *Dulingi* of the Bhoteas) is a very poisonous form of *Aconitum ferox*, so poisonous, indeed, that the Katmandu druggists will not admit they possess any. *Pahlo* (yellow) *bikh* is a less poisonous form of the same plant, known to the Bhoteas as *Holingi*, while *Setho* (white) *bikh* (the *Nirbisi sen* of the Bhoteas) is *A. Napellus*, and *Atis* is *Aconitum heterophyllum*. The aconite adulterants or plants used for similar purposes are, *Cynanthus lobatus*, the true *Nirbisi* of Nepal, the root of which is boiled in oil, thus forming a liniment which is employed in chronic rheumatism, *Delphinium denudatum*, the *Nilo* (blue or purplish) *bikh* of the Nepalese and the Nirbisi of the Bhoteas, Dr. Gimlette says, is used by the *Baids* of Nepal for the same purposes as the *Setho* and *Pahlo bikh*. *Geranium collinum* (*var-Donianum*) is the *Ratho* (red) *bikh* of the Nepalese, and the *Nirbisi-num* of the Bhoteas, and, like the *Setho bikh*, is given as a tonic in dyspepsia, fevers, and asthma. Lastly, a plant never before recorded as used medicinally, namely, *Caragana crassicaulis*, is known as the *Artiras* of the Nepalese, and the *Kurti* of the Bhoteas; it affords a root which is employed as a febrifuge."

The Jadwár or Nirbisi myth appears to have been invented in the East to account for the curious occurrence on the

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Himalayas of poisonous and non-poisonous aconites growing side by side (see Vol. I., pp. 1, 15, 18, 20).

It would appear also that the Curcumas have no claim to the name of zedoary, which was probably first given to them about the middle of the 16th century, as Clusius's figure of Gedwar is certainly meant for the pendulous tuber of a Curcuma. The substitution of the cheaper for the more expensive article is rendered highly probable by the fact that Zerumbet was considered by the Arabians to be very little inferior to Jadwár as an antidote to poisons. Ibn Sina, Ibn Baitar, and Ibn Jazla in the *Minháj* use almost the same words in speaking of these drugs ; of Jadwár they say :—هو ترياق السموم باسرها حتي البيش والافاعي, "it is an antidote for all poisons, even those of aconite and the viper"; and of Zerumbet—من ينفع لنزع الهوام جدا حتي يقارب الجدوار "it is most useful against the bites of venomous animals, and is almost equal to Jadwár." Both drugs were considered to have properties similar to *Darunaj* (see Vol. II., p. 292). Ainslie (*Mat. Ind.*, i, 492) remarks that *C. Zedoaria* is the *Lampooyang* of the Javanese, and the *Lampuium* of Rumphius (*Herb. Amb*, V., p. 148), and that it is a native of the East Indies, Cochin-China, and Otaheite. He quotes Geoffroy's description of the drug, which leaves no doubt as to its identity with the modern Kachora—"Foris cinerea, intus candida; sapore acri-amaricante aromatico; odore tenui fragrante, ac valde aromaticum suavitatem, cum tunditur aut manducatur, spirante et ad camphoram aliquatenus accedente." Guibourt states that *C. Zedoaria* is the Zerumbet of Serapion, Pomet, and Lemery. The following is his description of it :—"The round zedoary is greyish-white externally heavy, compact, grey and often horny internally, having a bitter and strongly camphoraceous taste, like that of the long zedoary, which it also resembles in odour. The odour of both drugs is analogous with that of ginger, but weaker unless the rhizome be powdered, when it developes a powerful aromatic odour, similar to that of cardamoms." (*Hist. Nat.* 6me. Ed., Vol. II., p. 213.) In our opinion there is no doubt that *C. Zedoaria* is the source of the round and long zedoary of commerce. The plant is common in Bombay gardens, and

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was probably introduced by the Portuguese, whose descendants and converts at the present day use the leaves in cookery, especially with fish. From Dr. Hové's account of Bombay in 1787 it appears that Kachúra and Turmeric were cultivated at that time in the cocoanut woods at Mahim. The natives chew the root to correct a sticky taste in the mouth; it is also an ingredient in some of the strengthening conserves which are taken by women to remove weakness after child-birth. In colds it is given in decoction with long-pepper, cinnamon and honey, and the pounded root is applied as a paste to the body. Rheede says that the starch of the zedoary is much esteemed, and that the fresh root is considered to be cooling and diuretic, it checks leucorrhœal and gonorrhœal discharges and purifies the blood. The juice of the leaves is given in dropsy. One of us has had the plant in cultivation for some years; it blossoms in the hot weather just before the rains, when the first leaves begin to appear.

Description.—Guibourt's description already given agrees exactly with the Kachúra of India, but it is often cut into transverse slices instead of into halves and quarters.

Microscopic structure.—This is essentially the same as that of turmeric, but the resin and essential oil in the cells is of a yellowish-white colour, and the greater portion of the starch grains are ovoid or pyriform, instead of narrow and elongated as in turmeric.

Chemical composition.—Zedoary contains, according to Bucholz (*Repert. Pharm. xx.*, 376), volatile oil, a bitter soft resin, a bitter extractive matter, gum, starch, &c. The oil is turbid, yellowish-white and viscid, has a camphoraceous taste and smell, and consists of two oils, one lighter, the other heavier than water. Trommsdorff obtained from the root a substance which he called *Zedoarin*, but did not further describe it. A proximate analysis afforded:—

Essential oil, resin, curcumin, &c.	3·79
Resins, sugar	·90
Gum and organic acids	15·22
Starch	17·20

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Crude fibre	10·92
Ash	6·06
Moisture	10·31
Albuminoids, Arabins, &c.	35·60
	100·00

Commerce.—The Bombay market is supplied from Ceylon. Value, Rs. 20 to Rs. 30 per candy of 7 cwts. The drug is chiefly used in India as a cosmetic. Roxburgh states that Bengal is supplied from Chittagong.

CURCUMA CÆSIA, *Roxb.*

Hab.—Bengal. Often cultivated. The tubers.

Vernacular.—Nar-kachúra, Káli-haldi (*Hind.*, *Guz.*), Káli-halad (*Mar.*), Káli-halad, Nilkanth (*Beng.*), Mána-pasupu (*Tel.*).

History, Uses, &c.—This drug is one of the two Zerumbáds of modern Persian writers on Materia Medica. Strange to say, it is not noticed by most European writers on Indian drugs, though it is well known and to be found in all the shops. It is the *Tommon itam* of Rumphius, and the *Carcuma long.* of Guibourt, who classes it with the turmerics. See *Hist. Nat.*, II., p. 210, 6me Ed., where a figure will be found. Guibourt's description is as follows:—" Ce curcuma est en tubercules cylindriques, c'est-à-dire qu'il conserve sensiblement le même diamètre dans toute sa longueur, malgré ses différentes sinuosités. Il est plus long que le précédent, mais beaucoup plus mince, n'étant jamais gros comme le petit doigt; sa surface est grise, souvent un peu verdâtre, rarement jaune, chagrinée, ou plus souvent nette et unie. Il est à l'intérieur d'une couleur si foncée qu'il en parait rouge-brun, ou même noir. Il a une odeur aromatique très dévelopée, analogue à celle du gingembre; sa saveur est également très aromatique et cependant assez douce et nullement amère. Il est impossible de méconnaitre dans cette racine les articles digités du *Curcuma domestica minor.* Enfin, on trouve dans le curcuma du commerce, mais en petit quantité, des tubercules

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ronds de la grosseur d'une aveline, souvent didymes, ou offrat les restes de deux stipes foliacés. Ces tubercules offrent d'ailleurs tous les caractères des précédents, et sont les *matrices radicis* du *Curcuma domestica minor*." Nar-kachùra appears to have been once imported into Liverpool under the name on *Kutchoo*. (*Phar. Jour.* (II.), Vol. I., p. 17.) Aitchison (*Notes on Prod. of W. Afghanistan and N. E. Persia*, p. 51) remarks:— "Zedoary, *jidwár*, *jizwar*, *kachur*, *kachul*, is imported in quantity from India, most of it to be passed on to Turkistan. The long tubers are called *nar-kachul*, and the round ones *mada-kachul*, as if they were the products of two different plants, but I have only seen them mixed together, and not sold as two distinct roots. The Turkomans employ these roots as a rubefacient, to rub their bodies down with after taking a Turkish bath. In this part of the country, in lieu of these, the nodes on the roots of *Eremostachys labiosa* and another species are collected and sent on to Turkistan. Curcuma roots are employed a little in native medicine, and as a condiment."

The plant is a native of Bengal, and is cultivated there to supply the Indian market. Nar-kachúra is considered to have nearly the same medicinal properties as Kachúra; it is chiefly used as a cosmetic. The author of the *Makhzan* describes it as a kind of Zerumbád. (See *Makhzan*, article "Zerumbád.") Through the kindness of Surgeon-Major Peters we have been supplied with living tubers of this Curcuma from Dinapore; he informs us that it is common in gardens in Bengal, and is used as a domestic remedy in the fresh state much as turmeric is in this part of India. The fresh tubers are of a pale yellow colour, but after boiling and drying we find that they assume the *couleur foncée* of the drug found in the shops.

Description and Microscopic structure.—The minute structure of this tuber hardly differs from that of the zedoary. The starch contained in the cells of the parenchyme has been altered by heat, and appears as a finely granular mass nearly filling the cell. The resin cells are about as numerous as in the zedoary, but the contents are of a dusky orange colour. The vascular system consists of scalariform and spiral

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vessels. As to the drug, it consists of small nearly globular central tubers, from which spring numerous lateral rhizomes about the size of ginger. It is of a dark-grey colour externally and marked with circular rings. Internally it is very hard and horny, of a greyish black, but when cut in thin slices of a greyish-orange. The odour and taste are camphoraceous.

Chemical composition.—A proximate analysis of this curcuma afforded :—

Essential oil, resin, &c.	4·47
Resins, sugar, &c.	1·21
Gum, organic acids, &c.	10·10
Starch	18·75
Crude fibre	25·20
Ash	7·57
Moisture	9·76
Albuminoids, &c.	22·94
	100·00

Commerce.—The drug comes overland from Bengal. Value, Rs. 4 to Rs. 5 per maund of 41 lbs. Guibourt appears to have become acquainted with it from its admixture with the turmeric of commerce.

Curcuma Amada,—*Roxb., Rosc. Scit. t.* 99, a native of Bengal, is the Am-haldi or Am-ada (mango ginger) of the natives of India. The lateral tubers, which are of the size and shape of ginger, and of a pale yellow colour, have an agreeable odour like the rind of the mango fruit. They are much used in Bengal as an ingredient in *chutneys*, and are considered to be carminative, stomachic, and cooling. In their medicinal properties they resemble ginger. The plant is hardly known in Western India, and is not the Amba-halad or mango turmeric of Bombay, which is *Curcuma aromatica.*

INDIAN ARROWROOT.

Indian or **Curcuma Arrowroot** is obtained from the following plants :—

Curcuma angustifolia, Roxb., a native of the tropical Himalaya and Oudh.

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Curcuma leucorhiza, Roxb., a native of Behar. (*Rosc, Scit.*, *t.* 102.)

Curcuma montana, Rosc., a native of the Concan and Circars. (*Roxb. Cor. Pl.*, *t.* 151.)

Curcuma longa, Linn. The Turmeric plant. (*Bentl. & Trim.*, *t.* 269.)

Curcuma aromatica, Salisb., a native of the plains of India. (*Rosc. Scit.*, t. 103.)

Curcuma rubescens, Roxb., a native of Bengal.

Hitchenia caulina, Baker, a native of the Concan. (*Journ. Bomb. Nat. Hist. Soc.*, II., 140.)

Vernacular.—Tikhur (*Hind.*, *Beng.*), Tavakhir (*Mar.*).

History, Uses, &c.—Tavakshiri, and Tavakshiryeka-pattrika are Sanskrit names for certain species of Curcuma, from which are derived the vernacular terms *Tavakhir* and *Tikhur*, now in common use for Curcuma starch. The starch is prepared in many parts of India by grating or pounding the tubers, mixing the pulp thus obtained with water, straining it through a cloth, and allowing the liquid to stand until the starch separates. This, after several washings in water, is dried in the sun, and after powdering is ready for use.

The following account of the experimental cultivation of *C. angustifolia* and of the preparation of its starch at the Saidapet Experimental Farm, Madras, gives the most exact information we possess regarding the yield and cost of Curcuma Arrowroot:—"A flat measuring 0·25 acre was planted with this crop at the end of 1879, and remained down during the year under report. It was taken up at the end of January 1881 and yielded 986 lbs. of tubers, or at the rate of 3,944 lbs. per acre. The yield of flour obtained has generally been about 12½ lbs. from 100 lbs. of tubers, so that the above yield would represent an outturn of 493 lbs. of flour per acre. In another case in the College Experimental Garden, a plot measuring 1,160 square yards, planted with this crop yielded 1,793 lbs., or at the rate of 7,500 lbs. per acre. The culture of the plant is very simple: it is only necessary to plant the sets in properly prepared soil,

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and to water them occasionally during the dry season. The removal of the crop is tedious unless the tubers can be ploughed out, as potatoes are in England, which is seldom possible, owing to the dryness of the soil. The flour can be sold profitably at four annas per pound, and at this rate Rs. 400 per acre could be realized."

Mr. Hamilton, F.C.S., to whom samples of the starch were submitted, reported that the mucilage yielded by a sample marked "1st sort" was nearly as good as that of Maranta arrowroot, but that the sample when soaked in cold water gave indications of the presence of slight acidity, and also contained a small proportion of soluble starch. He suggested the avoidance of unnecessary exposure to the sun, and the addition of ½ an ounce per gallon of caustic soda to the water used in steeping the pulped roots. All the samples sent to him contained extraneous matters, black particles, straw, &c., introduced during the process of drying, which, it is hardly necessary to say, would render the article unsaleable in Europe.

Curcuma arrowroot is inferior in colour to Maranta arrowroot; under the microscope it may differ greatly in appearance, as the starch grains of different species of Curcuma are variable in size and shape.

Commerce.—Madras in 1869-70 exported 3,729 cwts. of Curcuma arrowroot, valued at Rs. 14,152. In Bombay "Malabar Arrowroot" fetches from Rs. 3 to Rs. 4 per maund of 28 lbs.

CURCUMA LONGA, *Linn.*

Fig.—*Bentl. and Trim., t.* 269; *Rheede, Hort. Mal. xi., t.* 11. Turmeric (*Eng.*), Curcuma, Souchet des Indes, Safran des Indes (*Fr.*).

Hab.— Parasnathin Behar. Cultivated elsewhere. The tubers.

Vernacular.—Haldi, Haldar, Halja (*Hind.*), Halad (*Beng., Mar., Guz.*), Manjal (*Tam.*), Pasapu (*Tel.*), Mannal, Marinalu (*Mal.*), Arishina (*Can.*).

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History, Uses, &c.—Turmeric appears to have come into use in India as a substitute for saffron and other yellow dyes, which were used by the ancient Arians before they invaded the country. The Arians were, as we know, great worshippers of the solar system, hence they held in special estimation those plants which yield a golden-yellow dye resembling sunlight, and attributed to them protective and auspicious properties.

Turmeric, best known as Haridra in Sanskrit, has forty-six synonyms, such as Pita "yellow," Gauri "brilliant," Varnavat "having colour," Kamala "lustful," Nisa, Rajani, and all other words which signify "night." The use of the latter synonyms is variously explained. A distinguished professor of Sanskrit, whom we consulted, referred us to one of the best commentators on the *Amarakośa*, who states that turmeric being a substance used for dyeing came to be called *rajani*, which etymologically means the material by which a thing is dyed, because the word *rajani* had already come to be used in the language to denote "night." A well-known Bombay *Vaid*, to whom we put the question, replied, "We have tradition that it is called 'night,' because in former times married women used daily to apply turmeric in the evening." On further enquiry we learned that this practice is not extinct, as he supposed, but still prevails in Goan villages, about Asnora, and probably elsewhere. Married women in the evening, when the house-work is completed, dip their hands in turmeric water and pass them lightly over their cheeks: the mistress of the house also performs the same office for any married friend who may happen to drop in at this time, and on some pretence detains her until the lamps are lighted. The reason they give for doing this is that the goddess Lakshmi may visit the house at this time. This goddess is regarded as the wife of Surya, and the practice is probably a survival of sun-worship. In Hindu ceremonial turmeric is almost always necessary. Amongst the most important occasions on which it is used we may mention the following as prevailing in most parts of India :—

A few days before the marriage ceremonies commence, five married women, or five virgins, anoint the bride with turmeric

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and oil upon the forehead, head, breast, back, and feet, and the bride puts on a robe dyed with turmeric, which she wears until the day of the marriage. Turmeric and oil is sent from the house of the bride to the bridegroom, who is anointed in a similar manner, and sends back a similar present to the bride.

The marriage contract is stained or spotted with turmeric. During the ceremonies the sisters of the bridegroom perform *árta* before him with a dish of turmeric water, and, dipping their fingers in it, touch his forehead.

A portion of the wall is daubed with turmeric and dashes of *kunku* after the arrival of the bride in the bridegroom's house, and before it are placed the *kul* and all the clothes and ornaments constituting the marriage presents; the bridegroom, and after him the bride, prostrate themselves before this spot.

The bridegroom ties a thread round the bride's wrist, to which is attached a piece of turmeric and a betelnut.

Towards the end of the ceremonies the bridal party play with turmeric water dashing it over one another.

A woman who performs *sati* and married women when they die are taken to the funeral pile clothed in a robe dyed with turmeric.

At all times when *púja*, or worship of the gods, is made, turmeric is necessary.

When a new *sári* (robe) has been purchased, two threads are drawn out, one of which is offered to Surya, and the other to the goddess Tulasi, and turmeric is applied to the corner of the cloth.

Turmeric powder and *kunku* (a pigment made with turmeric and lime) is presented to women who have husbands living, and to temple dancing girls, in the month of Chaitra, or upon the occasion of the Nauratra.

The Akshata rice used in various ceremonies is coloured with turmeric and lime.

In the *Ramayan* turmeric is mentioned as one of the eight ingredients of the *Arghya*, a respectful oblation made to gods

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and venerable men. The following are the lines as given in the Hindi version of that poem:—

Dahi, dúrba, rochan, phal, múla,
Nav tulsi dal, mangal-mula.

Curdled milk, Durva grass,
Yellow gall stones of the cow, Fruit,
Roots, Lotus and Tulsi leaves,
Turmeric.

Medicinally turmeric is described in the Nighantás as hot, bitter, pungent, astringent and drying; it corroborates the humors, prevents skin diseases, is a useful application to swellings, boils, &c., and is given in jaundice. As a domestic remedy it is in daily use; rubbed down with oil it is applied to any roughness of the skin, with lime to bruises, sprains, and all kinds of wounds; a decoction forms a cooling eyewash, boiled with milk and sugar it is the popular remedy for a cold, the fumes are inhaled by those suffering from severe coryza, cloth dyed with turmeric is used as an eye-shade, and *ghi* mixed with powdered turmeric is given to relieve cough. As a spice the powder is an ingredient in curries and sweetmeats, and is used by every native of India. The leaves are also used as a condiment, especially with fish, which is wrapped in them and fried.

It is doubtful whether turmeric was known to the Greeks. Dioscorides mentions an Indian root as a kind of κύπειρος resembling ginger, but having, when chewed, a yellow colour and bitter taste. The Mahometans use turmeric medicinally in the same manner as the Hindus; they also prescribe it in affections of the liver and jaundice on account of its yellow colour. There are many Arabic names; the best known are Urúk-es-sufr "gold root," and Uruk-es-sabághín "dyers' root." The modern Persian name is Zard-chubah "stick saffron." The editor of the *Pharmacopœia of India* speaks favourably of the use of a decoction of turmeric in purulent conjunctivitis; he says it is very effectual in relieving the pain. In coryza he states that the fumes of burning turmeric directed into the nostrils cause a

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copious mucous discharge, and relieve the congestion. (*Op. cit.* p. 231.)

Cultivation.—Turmeric requires a loamy soil and abundance of manure and water; the ground must be well worked and raised into ridges, 9 or 10 inches high and 18 to 20 broad, with intervening trenches 9 to 10 inches broad. The sets, which consist of small portions of the root, are planted on the tops of the ridges, at about 18 inches to 2 feet apart. One acre requires about 900 such sets, and yields about 2,000 lbs. of the fresh root (*Roxb.*). Other authorities state the yield at from 1,000 to 2,000 lbs. Dalzell and Gibson give very much higher figures for the best garden soil in Guzerat, *viz.*, 5,000 to 20,000 lbs. per acre. They state that the return to the cultivator is equal to that obtained from sugar-cane, *viz.*, Rs. 300 per acre. The time for planting is usually about the end of May, but it depends greatly upon the setting in of the rainy season. The crop may be raised in the following March or April; if left in the ground new shoots appear upon setting in of the following rains and the crop is lifted about 20 to 21 months after planting. In some parts of India it is not considered good practice to lift the plants the first year. When lifted, the roots have to be scalded in boiling water or by steaming them in their own juice, and to be dried in the sun or in an oven. Turmeric being much cultivated along with other crops it is impossible to obtain any reliable acreage returns.

Description.—The rhizome of the turmeric plant, like that of most Curcumas, consists of a central ovoid portion and several lateral elongated portions, all of a deep orange colour, from these proceed a number of radicles, at the ends of some of which colourless oval tubers are produced. The central and lateral rhizomes form the round and long turmeric of commerce. The former vary a good deal in size and shape; they may be pyriform, ovoid, or almost round, and are generally cut up into two or more pieces; the latter are cylindrical, tapering towards the extremities, and often more or less bent; both are marked by transverse furrows, and bear remains of the rootlets and

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leaf-buds. Turmeric is of a deep brownish-yellow colour, of firm resinous consistence, and has a peculiar aromatic odour.

Microscopic structure.—Sections of the fresh rhizome show the exterior to be composed of several layers of compressed brown cells. The parenchyme consists of delicate polygonal cells of a yellow colour, the majority contain starch grains which are mostly elongated, but some are pyriform or ovoid; a smaller number of cells contain globular masses of yellow resinous matter, and a rich orange-yellow essential oil; those cells which contain much resin have little or no oil, when the resin is in small quantity there is much oil. The vascular system consists of scalariform and spiral vessels, which are most abundant near the boundary line which separates the cortical from the central portion of the rhizome. This boundary line is composed of small empty cells, having thicker walls than those of the rest of the parenchyme.

Chemical composition.—Turmeric contains about 1 per cent. of an essential oil. *Curcumin*, the yellow-colouring matter of turmeric, has been examined by several chemists, whose experiments have led to the conclusion that its formula is either $C^{10}H^{10}O^{3}$ or $C^{16}H^{16}O^{4}$ that it melts at 172°, forms red-brown salts with alkalies, is converted by boric or sulphuric acid into *rosocyanine*, by reduction with zinc-dust into an oily body, by oxidation into oxalic or terephthalic acid, and by fusion with potash into protocatechuic acid. The experiments of Jackson and Menke have, however, led to results differing in many respect from those above detailed, which were probably obtained from impure preparations.

The Curcumin used in their experiments was prepared by treating ground turmeric root (Bengal or Madras) with light petroleum to remove turmeric oil, and then with ether, which dissolves the curcumin together with a large quantity of resin; and it was finally purified by crystallization from alcohol. The quantity of curcumin thus obtained was only 0·3 per cent. of the root; the total quantity contained in the root is, however, much larger, as a considerable amount remains mixed with the

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resinous impurities, and some also in the oil. Curcumin thus prepared crystallizes from alcohol in stout needles, appearing on microscopic examination to be made up of well-formed prisms with square ends, or in spindle-shaped crystals often arranged in radiate groups. It has an orange to yellow colour, according to the size of the crystals, with a beautiful blue reflex; its solution in ether exhibits a strong green fluorescence. It is inodorous when pure; melts at 178°, apparently with decomposition. It is nearly insoluble in water, somewhat soluble in cold, more readily in hot ethyl and methyl alcohols, more soluble in glacial acetic acid, less in ether, very slightly in benzene and carbon bisulphide, and all but insoluble in light petroleum. Strong sulphuric acid dissolves it with a fine reddish purple colour, gradually changing to black from charring; curcumin dissolves readily in alkalies and alkaline carbonates. Its ammoniacal solution gives off ammonia when boiled, and deposits unaltered curcumin. Baryta water converts it into a blackish-red powder, but lime water gives a red solution like that obtained with calcium carbonate. Curcumin is not affected by acid sodium sulphite. Pure curcumin gives, as the mean of several analyses, 68·30 per cent. carbon and 5·63 hydrogen, leading to the formula $C^{14}H^{14}O^{4}$, which requires 68·29 carbon, 5·69 hydrogen, and 26·02 oxygen, and this formula has been confirmed by the analysis of several derivatives. For an account of the derivatives of curcumin, confer. *Phar. Journ.*, Dec. 30th, 1882.

Turmeric oil or *Turmerol,* to which turmeric (and therefore curry powder) owes its aromatic taste and smell, has been extracted from Bengal turmeric by C. L. Jackson and A. E. Menke with light petroleum, and after being freed from the higher-boiling portion of that solvent by heating to 150° in a flask, it formed a thickish oily yellow liquid having a pleasant aromatic odour. It was purified by fractional distillation under diminished pressure, and was thereby separated into three portions, the first boiling below 193°, the second at 193° to 198°, and the third consisting of a viscous semi-solid residue. The middle portion consisted of nearly pure turmerol; the first of that substance contaminated with hydrocarbons from the

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petroleum. The middle fraction, after further purification by distillation in a vacuum, gave, as a mean result of several analyses, 83·62 per cent. carbon and 10·42 hydrogen, agreeing nearly with the formula $C^{19} H^{29} O$, which requires 83·81 C. and 10·29 H. Turmerol is a pale yellow oil having a pleasant aromatic smell, and a density of 0·9016 at 17°. It is optically dextrogyrate, [a]=33·52. Under ordinary pressure it boils at 285° to 290°, but decomposes at the same time, yielding a substance of lower boiling point. (*Amer. Chem. Journ.*, IV., pp. 368-374.) Schimmel and Co. (*Bericht, Oct.* 1890) state that during a scientific investigation of Curcuma oil they proved it to contain *Phellandrene.*

Commerce.—The bulk of the turmeric cultivated in India is consumed in the East as a dye and condiment, and the consumption must be very large as every one uses it. Full particulars cannot be learned, but a trans-frontier trade exists, and the various Indian ports exchanged in 1886-87, 281,117 cwts., valued at Rs. 24,38,260. During 5 years from 1884 to 1888 Tuticorin exported 6,802 cwts. of turmeric at the average valuation of Rs. 7-8 per cwt. In the foreign trade turmeric is treated as a dye, and the statistics include the wild or Cochin kind. In 1885-86 the exports were 156,287 cwts., valued at Rs. 14,00,000; in 1886-87, 140,994, cwts. were exported, valued at Rs. 10,32,025. The trade fluctuates greatly: in 1881-82 only 70,783 cwts. were exported; in 1876-77, 123,824 cwts.

KÆMPFERIA GALANGA, *Linn.*

Fig.—*Rosc. Scit., t.* 92; *Wight Ic., t.* 899; *Rheede, Hort. Mal. xi., t.* 41.

Hab.—In the plains throughout British India. The tubers.

Vernacular.—Chandra-múla (*Hind.*), Chandú-múla, Húmúla (*Beng.*), Kachula-kalangu (*Mal., Tam.*), Chandra-múla, Utnen (*Mar.*), Kapúr-kachri (*Guz.*).

History, Uses, &c.—The plant is called Chandra-múla or Chandra-mulika in Sanskrit, but it is not mentioned in the

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Raja-nirghanta. It is much cultivated in gardens by the Hindus, whose women use the aromatic leaves and roots as a perfume when washing their hair; on this account the vernacular names *Utnen* and *Kapur-kachri* have been given to it in Western India, as its odour exactly resembles that of the root of *Hedychium spicatum*, which is sold in the bazars as a *Kapur-kachri*, and is an ingredient in the *Utnen* or perfumed powder for the hair, which has been described in Vol. ii., p. 234. Rheede states that the tubers reduced to powder and mixed with honey are given in coughs and pectoral affections, boiled in oil they are applied externally to remove obstructions in the nasal passages. In the *Dict. Econ. Prod. of India* (IV, 561), it is stated on the authority of Mason that the roots are often seen attached to the necklaces of Karen women, for the sake of their perfume, and that they also place them in their clothes for the same reason. They are also said to be used as a masticatory along with betel leaves and areca nut.

Description.—The roots consist of branched tubers, resembling ginger in form, which give off fleshy fibres bearing white pendulous tubers; they have a peculiarly agreeable camphoraceous odour, exactly like that of the Kapur-kachri of the bazars. The leaves are radical, petioled, ovate-cordate, between acute and obtuse; margins membranaceous and waved; upper surface smooth, deep green; under surface pale and somewhat woolly. The leaves are much crowded, but when they can find room they spread flat on the surface of the earth, the petioles are hid beneath the soil and form cylindric sheaths enclosing the fascicles of flowers, which are of a pellucid white, or white marked with purple spots, and have the same fragrant odour as the leaves and roots. All parts of the plant have a bitterish and camphoraceous taste.

The roots are not met with in commerce, but, judging from some which we have sliced and dried, would appear to be capable of supplying an article equal to the *Kapur-kachri* of the shops. (See *Hedychium spicatum*). The plant is cultivated with the greatest ease, and yields a large crop of roots.

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Chemical composition.—The fatty matters dissolved out of this tuber by ether consisted of a fragrant liquid oil, and a solid white crystalline substance separated by petroleum ether. The alcoholic extract, amounting to 2·76 per cent., contained some white transparent prisms of an alkaline nitrate, and a few nodules of a circular-shaped crystals of a yellowish colour. This extract contained a small quantity or alkaloid, and some sweet body reducing Fehling's solution. A large quantity of starch is present, and 4·14 per cent. of gum. The tubers dried at 100°C lost 4·11 per cent. of moisture, and yielded 13·73 per cent. of mineral matter.

KÆMPFERIA ROTUNDA, *Linn.*

Fig.—*Rosc. Scit.*, *t.* 97; *Bot. Mag.*, *t.* 920 and 6054; *Wight Ic.*, *t.* 2029; *Rheede, Hort. Mal.* xi., *t.* 9.

Hab.—Throughout India, often cultivated.

Vernacular.—Bhume-champa (*Hind.*), Bhin-champa (*Beng.*), Bhin-champo (*Guz.*), Bhin-chapha (*Mar.*), Konda-kalava (*Tel.*), Malan-kua (*Mal.*)

History, Uses, &c.—This plant, called in Sanskrit Bhumi-champaka, "ground champaka," from the sweetness of its flowers resembling that of the champaka (*Michelia*), though not mentioned in the Raja-nirghanta, is one of the commonest domestic remedies of the Hindus. Its small globular pendulous tubers, at one time supposed to be the "round zedoary" of the druggists, are used throughout India as a local application to tumours, wounds, and swellings of all kinds. Rheede states that in Malabar the whole plant, when reduced to powder, and used in the form of an ointment, is considered to be of wonderful efficacy in healing fresh wounds, and that, taken internally, it is thought to remove any coagulated blood or purulent matter that may be within the body; he adds that the root is a useful application to anasarcous swellings. In Western India the tubers are used as a popular local application in mumps* (*Gal-*

* Tuberous roots were used by the ancients for the same purpose. Cf. Scrib. Larg. Comp. 44.

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gand), but as they are generally combined with more active remedies, such as Croton seeds, Aconite, and Nux Vomica, it is probable that they do not contribute much to the cure. The root consists of several central, almost globular rhizomes, from which proceed numerous, thick, fleshy rootlets, all of which terminate in small, oblong, or round tubers; the substance of the rhizomes and tubers is of a pale straw colour, and has a bitter, pungent, camphoraceous taste, much like that of true zedoary; the whole plant is aromatic.

HEDYCHIUM SPICATUM, *Ham.*

Fig.—*Bot. Mag., t.* 2300.

Hab.—China Himalaya. The tubers.

Vernacular.—Kápúr-kachri, Kachúr-kacha, Kachri (*Hind.*), Kápúr-kachari (*Mar., Guz.*), Shimai-kichilik-kizhangu (*Tam.*).

History, Uses, &c.—Sati, the Sanskrit name for *Curcuma Zedoaria*, is sometimes erroneously applied to this plant, which is not mentioned in the *Raja Nirghanta*. In the Himalayas it is known as *Sheduri*, and the leaves are made into mats which are used as sleeping mats by the hill people. The aromatic root-stocks are used as a perfume along with Henna (*Lawsonia alba*) in preparing the cloth known in the North-West Provinces as Malagiri (*Watt*). The sliced and dried root is an article of considerable importance in Indian trade, as it is a principal ingredient in the three kinds of *Abír*, or scented powder, used by the Hindus in worship, and as a perfume. White Abír is made from the following ingredients:—The root of *Andropogon muricatus*, the tubers of *Hedychium spicatum*, sandalwood and arrowroot (Indian), or flour of Sorghum. The kind of Abír called *Ghísí* in Hindí, and *Padí* in Guzeráthí, contains in addition to the above ingredients the seeds of *Prunus Mahalib, Artemisia Sieversiana*, the wood of *Cedrus Deodara*, the tuber of *Curcuma Zedoaria*, cloves and cardamoms. Black Abír, or *Bukka* of the Deccan, contains in addition to all the above ingredients, Aloes-wood, costus, the root of *Nardostachys Jatamansi*, and liquid Storax. The scented powder of the Jains called *Vásakhepa* or

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Vásakshepa, does not contain it, but consists of sandalwood, saffron, musk, and Borneo camphor. Two kinds of Kápúr-kachrí are found in the Bombay market, *viz.*, Chinese and Indian; the latter was supposed by Royle to be the *Sittarittee* or lesser Galangal of Ainslie (*Mat. Ind.* I., p. 140), but Moidín Sheriff states that the Sittarittee of the Tamils is the true lesser Galangal, which statement appears to be correct. Powell informs us that the rhizome is pounded with tobacco and smoked in the Punjab.

Description.—Indian Kápúr-kachrí occurs in slices, mostly circular, but sometimes the section is made in a sloping direction; the slices are ½ an inch or less in diameter, and vary much in thickness; they are white and starchy, and when freshly pared exhibit a faint line dividing the cortical from the central portion; the edges of each slice are covered by a rough reddish-brown bark marked with numerous scars and circular rings; here and there rootlets remain attached; the odour is like that of orris root, but more powerful and strongly camphoraceous; the taste pungent, bitter, and aromatic. The Chinese drug is a little larger than the Indian, whiter, and less pungent; the bark is smoother and of a lighter colour.

Microscopic structure.—The rhizome consists of a delicate parenchyma, most of the cells of which are loaded with large ovoid starch grains, a few contain a yellowish resin, and essential oil; the epidermis is composed of several rows of compressed, nearly empty, reddish-brown cells. From the unaltered condition of the starch it appears that the rhizomes are not exposed to heat.

Chemical composition.—The dried tubers have been examined by J. C. Thresh (*Pharm. Journ.* [3] XV, 361). The proximate analysis gave the following results:—

Soluble in petroleum ether—		
Ethylmethylparacoumarate..............	3·0	5·9
Fixed oil and odorous body..............	2·9	
Soluble in alcohol—		
Indif. substance ppt. by tannin...............		2·7
Acid resin, &c.		

Soluble in water—

Glucoside or saccharine matter	1·0
Mucilage	2·8
Albuminoids, organic acid, &c.	1·9
Starch	52·3
Moisture	13·6
Ash	4·6
Cellulose, &c.	15·2
	100·0

The odorous principle was entirely taken up by petroleum ether, upon allowing the petroleum ether to evaporate slowly, an abundant crop of large, colourless, tabular crystals was obtained, together with a pale yellowish-brown oily fluid. These crystals, after washing with cold petroleum, were submitted to a series of recrystallizations in order to remove traces of the odorous matter. They were finally obtained quite odourless, and found to possess the following properties:—Soluble in petroleum ether, ether, alcohol, chloroform and benzol. Insoluble in diluted solutions of potash, soda or ammonia. Sulphuric acid dissolved it in the cold without production of colour, but if heated the solution became purple red. The alcoholic solution was neutral in reaction, not coloured by ferric chloride or precipitated by basic lead acetate. It did not reduce silver salts.

The melting point (uncorrected) was found to be 120—121° F. (49° C.), and after melting it would remain fluid at ordinary temperatures for days if left undisturbed.

By burning with copper oxide in a current of oxygen the following results were obtained:—

·2931 gram yielded ·7490 gram CO^2 and ·1804 gram H^2O.

·2703 gram gave ·6912 gram CO^2 and ·1690 gram H^2O.

These results agree with the empirical formula $C^{12}H^{14}O^3$:—

The uncrystallizable portion of the petroleum ether residue was found to consist of the odorous principle, a fixed oil and a very considerable proportion of ethylmethylparacoumarate, the latter doubtless prevented from crystallizing by the presence

of the former. Upon saponification of the mixture with alcoholic potash, two crystalline acids were obtained, the *methyl-paracoumaric* and another, apparently a fatty acid. This latter was totally insoluble in boiling water, but crystallizable from alcohol. The quantity obtained did not enable the author to identify it with certainty. A minute quantity of the oily fluid abovementioned dropped upon the clothes, rendered them highly odorous for a considerable length of time, or, if exposed caused a large room to be pervaded with an odour resembling that of hyacinths.

Commerce.—The Chinese drug which forms by far the greater proportion of the commercial article is shipped to Indian ports *viâ* Singapore, and is valued at Rs. 4½ per maund of 37½ lbs. Sir E. Buck (*Dyes and Tans of the N.-W. Provinces*) gives the export from Kumaon in 1875-76 as 95⅛ cwts., and also states that in the same year an equal quantity was exported from Garhwal, and 40½ cwts. from the Bijnor district. In Davies' *Trade Report* 25 maunds (about 2,000 lbs.) are given as the annual export *viâ* Peshawar to Afghanistan (*Dict. Econ. Prod. Ind.* IV., p. 208). The Indian kind is valued in Bombay at about Rs. 5 per maund of 37½ lbs. It is not so handsome in appearance as the Chinese, but is more odorous.

ZINGIBER OFFICINALE, *Rosc.*

Fig.—*Bentl. and Trim., t.* 270; *Rosc. Monand. Pl.,* 83; *Woodville, t.* 250; *Steph.* and *Ch., t.* 96.

Hab.—Cultivated throughout the East. The rhizome.

Vernacular.—(Fresh) adrak, adi, (dry) Sonth (*Hind.*); (fresh) Alen, (dry) Sonth (*Mar.*); (fresh) Ada, (dry) Sont (*Beng.*); (fresh) Inji, (dry) Shukku (*Tam.*); (fresh) Allam, (dry) Sonti (*Tel.*); (fresh) Hasisunthi, (dry) Vana-sunthi (*Can.*); (fresh) Adu, (dry) Sunth (*Guz.*); (fresh) Inchi, (dry) chukka (*Mal.*).

History, Uses, &c.—Ginger has been cultivated in India from prehistoric times; it is a native of the East, but is not now known in a wild state. In Sanskrit it bears many

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names, such as Mahaushadha "great remedy," Visva "pervader," Visva-bheshaja "panacea," Sringavera "antlered," Katubadra "the good acrid," &c. When dried it is known as Sunthi and Nágara in distinction from Ardraka "fresh ginger." In the Nighantás it is described as acrid and digestive, useful for the removal of cold humors, costiveness, nausea, asthma, cough, colic, palpitation of the heart, tympanitis, swellings, piles, &c. Ginger is one of the three acrids (trikatu) of the Hindu physicians, the other two being black pepper and long pepper; combined with other spices and sugar, as in the preparations known as *Samasarkara churna* and *Saubhagya sunthi*, it is given in dyspepsia and loss of appetite. In rheumatism preparations of ginger and other spices with butter are given internally, and it is an ingredient in oils used for external application. The juice of the fresh tubers, with or without the juice of garlic, mixed with honey, is a favourite domestic remedy for cough and asthma, with lime juice it is used in bilious dyspepsia, and a paste of dry ginger and warm water is applied to the forehead to relieve headache. In Western India, ginger juice, with a little honey and a pinch of burnt peacock's feathers, is the popular remedy for vomiting. In old Persian we find the names *Shingabir* or *Shangabir* and *Adrak* applied to ginger, and it was probably through the Persians that the Greeks first became acquainted with it, as their ζιγγίβερι is evidently derived from the Sanskrit *Sringavera* through the Persian form of the word. The Arabic name *Zanjabil* is of similar origin, the chief difference being the substitution of the letter J for G, which is not in the Arabian alphabet.

Ginger is described by Dioscorides as hot, digestive, gently laxative, stomachic and having all the properties of pepper; it was an ingredient in collyria and antidotes to poison. Pliny notices it in his chapter on peppers, but very briefly, and it does not appear to have been regarded as an article of much importance in his time.

In the second century of our era, ginger is mentioned as liable to duty (vectigal) at Alexandria along with other Indian spices.

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(*Vincent Com. and Nav. of the Ancients*, III, 695). Galen recommends it in paralysis and all complaints arising from cold humors; Paulus in neuralgia and gout. Ibn Sina and other Arabian and Persian physicians closely follow the Greeks, but enlarge upon its aphrodisiacal properties. In modern medicine the value of ginger as a carminative in atonic dyspepsia and flatulent colic, and as a masticatory in relaxed conditions of the throat is generally admitted.

The manufacture of ginger beer and ginger ale forms a large portion of the mineral water trade in England; indeed, some makers have acquired a special reputation for their production. Besides the large number of fermented and aërated ginger beers consumed at home, a good deal of ginger ale is shipped in glass bottles from Belfast, especially to the United States. About 16,000 packages or casks are so exported annually, for it has become a fashionable beverage in America among all classes.

According to the American official returns the imports in the two years ending June were as follows (the duty being 20 per cent.):—

	1888.	1889.
	Dozen bottles.	Dozen bottles.
Ginger ale and beer......	231,721	261, 828
Ginger cordial..................		262
Preserved ginger (35 per cent. duty) value......	$14,289	$2,670
	Hundredweights.	Hundredweights.
Raw ginger(duty free)	34,194	27,718

The value of the ginger ale and beer imported there was in 1887, $153,376; in 1888, $126,987, and in 1889, $92,001. The manufacture of ginger ale seems to have been commenced there also; for last year 3,512 dozen quarts were sent away from New York and New Orleans, besides what was locally consumed.

The number of uses to which ginger is applied besides as a spice, confection and medicine are many; for instance, we have gingerade, ginger ale, ginger beer, ginger brandy, ginger bread,

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ginger champagne, ginger cordial, ginger essence, ginger lozenges and ginger wine.

On the Continent of Europe, ginger is less used and appreciated than in England.

Soluble essences of ginger are required for making good ginger beer, and Belfast and American ginger ales. There are aërated and fermented ginger beers; the best unbleached Jamaica ginger, well bruised, being used for the latter. Ginger is also used for a kind of cordial and champagne.

Lastly, young ginger is candied and preserved to a considerable extent in the East, and comes into commerce under the section of "succades." The quantity imported into England from India and China ranges from 300,000 to 600,000 pounds, of the value of £11,000 to £25,000. The mode of preserving it is to steep the rhizomes in vats of water for several days, changing the water once. When taken out it is spread on tables and well pricked or pierced with bodkins. The rhizomes are then boiled in a copper caldron, then steeped for two days and nights in a vat with a mixture of water and rice flour. After this they are washed with a solution of lime, then boiled with an equal weight of sugar and a little white of egg is added to clarify.

After the ginger has been boiled a second time it is put in glazed jars of pottery, holding 1 pound, 3 pounds or 6 pounds, and covered with syrup. The syrup is changed two or three times, and then they are shipped in cases holding six jars.

The quality called "Mandarin" is put up in barrels. (*P. L. Simmonds, Amer. Jn. Pharm.* 1891.)

Description.—Many qualities of ginger are met with in Eastern commerce, which vary greatly in appearance; the fresh tubers also vary in size, flavour and colour in different soils. One variety found in gardens in the Concan has a darker colour than ordinary ginger and somewhat of a zedoary flavour; it is known as *Kala-Ala*, "black ginger." Dried ginger is known in two forms, namely, the rhizome with its epidermis, in which

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case it is called *coated*; or deprived of epidermis, and then termed *scraped* or uncoated. The pieces, which are called by the spice dealers *races* or *hands*, rarely exceed 4 inches in length and have a somewhat palmate form, being made up of a series of short, laterally compressed, lobe-like shoots or knobs. Uncoated Cochin ginger, which is the best kind produced in India, has a pale buff hue, and a striated, somewhat fibrous, surface. It breaks easily, exhibiting a short and farinaceous fracture with numerous bristle-like fibres and closely resembles Jamaica ginger in appearance and flavour. "Black" Cochin ginger is that dried in the wet weather by means of hot ashes. Bengal and Bombay gingers have a brownish or reddish external surface, and the fractured surface is harder and darker, the flavour is less delicate than that of the Cochin sort. Coated gingers are now seldom met with, but Indian commercial samples usually contain a proportion of shrivelled and imperfectly scraped roots.

Chemical composition.—Ginger has been very completely examined by J. C. Thresh. (*Pharm. Journ.* (3) xii., 721). He found Cochin ginger to contain volatile oil 1·350 ; fat, wax (?) and resin (in the petroleum ether solution), 1·205; neutral resin ·950; *a.* and *b.* resins, ·865; *Gingerol*, ·600 ; substance precipitated by acids, 5·350; mucilage, 1·450; indifferent substance precipitated by tannin, organic acids, &c., 6·800; extractive soluble in alcohol not in ether or water, ·280 ; alkaloid a trace; metarabin, 8·120 ; starch, 15·790 ; pararabin, 14·400 ; oxalic acid (as CaC^2O^4), ·427 ; cellulose, 3·750 ; albuminoids, 5·570; vasculose, &c., 14·763; moisture, 13·530 ; ash, 4·800. The essential oil is pale-yellow, lævogyre and not acrid. Gingerol, the active principle, is a straw-coloured, viscid, odourless fluid of extremely pungent taste.

According to S. J. Riegel, East India ginger yields 8 per cent. of oleo-resin, whereas Jamaica ginger only yields 5 per cent. It may be best extracted by alcohol, ether or chloroform, benzin will dissolve it, but it does not exhaust the drug as satisfactorily as the other solvents.

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Commerce.—Ginger is extensively cultivated in British India, from the Himalayas to Cape Comorin.

In the Himalayas it is successfully reared at elevations of 4,000 or 5,000 feet, requiring, however, a moist soil. The Malabar ginger, exported from Calicut, is the produce of the district of Shernaad, situated to the south of Calicut. In the Dacca district the natives cleanse the roots in boiling lime water, which probably injures much of the fragrant pungency, whereas in Jamaica they use simply plain water.

In order to dry ginger into what is called "sonth" in India —that is, to enable it to keep—the fresh roots are put into a basket, which is suspended by a rope, and then two men, one on each side, pull it to and fro between them by a cord attached, and thus shake the roots in the basket; this process is carried on for two hours every day for three days. After this the roots are dried in the sun for eight days, and again shaken in the basket; the object of the shaking being to take off the outer scales and skin of the roots. Two days further drying completes the process, and the ginger sells at about a rupee, or two, for 6 or 8 pounds. The value of the East Indian ginger exported went on increasing from about £63,000 (44,457 hundredweights) in 1881 to over £199,000 (133,280 hundredweights) in 1887; but in the last three years it has retrograded, having fallen to £70,398 (61,774 hundredweights) in the financial year ending March, 1890.

Last year, of 63,500 cwts. imported into England, India sent 53,500 cwts., Jamaica, 5,900 cwts., and West Africa, 2,600 cwts. *(P. L. Simmonds.)*

ZINGIBER CASSUMUNAR, *Roxb.*

Fig.—*Roxb. in As. Research.* 11, *t.* 7; *Bot. Mag.*, *t.* 1426; *Rox. Monand. Pl.*

Hab.—India. The rhizomes.

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Vernacular.--Ban-ada (*Beng.*), Nisa, Malabari-halad (*Mar.*), Karpushpu (*Tel.*), Ban-adrak, Ban-adi (*Hind.*).

History, Uses, &c.—This plant, in Sanskrit Vaśrndraka or "wild ginger," though not mentioned in the Rája Nirghanta, appears to be well known in most parts of India as a domestic remedy among the peasantry, who rub down the tubers with water for administration in diarrhœa and colic. Though Roxburgh has named this plant *Cassumunar,* it appears to be very doubtful whether its roots have ever been exported to Europe or have ever been an article of commerce in India. *Kattu-mannal* is a Malabar name for the yellow zedoary, and it appears to be this plant which has furnished the Cassumunar root of the druggists (cf. *Pereira, Mat. Med.,* ii., Pt. 1, p. 236). In odour and taste both roots are very similar. The Marathi name Nisa is Sanskrit and signifies "turmeric," and seems to indicate that the tubers of this plant are used as a substitute for that article by the peasantry.

Description.— The fresh rhizomes are 1 to 2 inches in diameter, jointed, compressed, with numerous white fleshy radicles, to some of which white tubers are attached. Each joint of the rhizome is furnished with a leaf bud. The epidermis is scaly, light-brown, the interior of a rich golden yellow, the odour is powerful and not very pleasant, like a mixture of ginger, camphor, and turmeric; the taste hot and camphoraceous.

Microscopic structure.— The epidermis is formed of many layers of compressed and obliterated cells. The parenchyma consists of large polyhedral cells; those in the cortical portion of the rhizome are nearly free from starch, but those in the central portion are filled with large ovoid starch granules. In all parts of the rhizome large cells full of a golden-yellow essential oil abound. The vascular system resembles that of turmeric.

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Chemical composition.—The drug yielded to analysis:—

Ether extract (essential oil, fat, and soft resins) ...	6·96
Alcoholic extract (sugar, resins)	7·29
Water extract (gum, acids, &c.)........................	13·42
Starch	15·08
Crude fibre	12·61
Ash	6·80
Moisture	7·66
Albuminoids, modifications of arabin, &c.	30·18
	100·00

The root had a pungent odour, similar to a mixture of camphor and nutmeg, the soft resin had a bitter and burning taste. The colouring matter had many of the reactions of curcumin, but was more readily bleached than true curcumin, and the colour of the powder was very fugitive. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid. The root contained more mucilage and sugar than that of *Curcuma aromatica.* We were unable to separate any of the "soapy extractive" mentioned in the analysis of Cassumunar root by Luca.

Costus speciosus, *Sm., Lam. Ill. i., t.* 3; *Rheede, Hort. Mal. xi., t.* 8.

Vernacular.—Keú (*Hind.* and *Beng.*), Peṅva पेंवा (*Mar.*), Kemuka (*Sans.*). Roxburgh notices a preserve made of the fresh roots which is considered wholesome and nutritious. *C. speciosus* is the *Tjana-kua* of Rheede and the *Herba spiralis hirsuta* of Rumphius. Ainslie, quoting Brown's History of Jamaica, says that the root is there used as a substitute for ginger, but is very inferior to it. (*Mat. Ind.* ii., 167.) In the *Calcutta Exhibition Catalogue,* the root is described as depurative and aphrodisiac; similar properties are attributed to it in the Concan, where it is very abundant in moist situations. The rhizome resembles the great Galangal in growth and structure, but has no aromatic properties, the taste being mucilaginous and feebly astringent; it could only be used as a substitute for ginger by being preserved with a quantity of that root sufficient to flavour it.

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ELETTARIA CARDAMOMUM, *Maton.*

Fig.—*Rheede, Hort. Mal. xi., tt.* 4 and 5; *Bentl. and Trim., t.* 267; *Woodville, t.* 231; *Roxb. Cor. Pl. iii., t.* 226. Malabar Cardamom (*Eng.*), Cardamome du Malabar (*Fr.*).

Hab.—West and South India. The fruit.

Vernacular.—Chhoti-iláyachi or iláchi (*Hind.*), Elaich, Gujrati-elaich (*Beng.*), Elchi (*Guz.*), Veldoda (*Mar.*), Ella-kai (*Tam.*), Yálakki (*Can.*), Elettari (*Mal.*), Elakaya, Vittula (*Tel.*).

History, Uses, &c.—The small cardamom, in Sanskrit Ela, is mentioned by Susruta. In the Nighantas it bears various synonyms, such as Truti, Kapota-varni "grey," Korangi, and Dravidi "coming from the Dravidian country." The large or Nepal cardamom (*Amomum subulatum*) is called Sthulaila "large Ela," and is described separately. Both kinds are considered to be digestive, pungent, light and hot, and are recommended in phlegmatic affections, such as cough, asthma, piles, and diseases of the bladder and kidneys. These two cardamoms are described by Ibn Sina under the name of قاقله (kakulah); he also describes separately under the name of هیلبوا (hilbawa) another kind of cardamom as more easily digested than the *kakulah*. This latter cardamom is the true *Cardamomum majus* or *Nutmeg cardamom* of Africa to which Pereira has given the name of *Amomum korarima*. We think that there can be no doubt that the Greeks were acquainted with the cardamoms of India which they appear to have first obtained from the Persians through Syria and Armenia. Dioscorides says:—"Choose that which is tough, well filled, closed; if not in this state, it is too old and has lost its aroma. The taste is pungent and somewhat bitter." With respect to the name Kátídáús, the Greeks appear to have applied it to this spice in much the same way as the Persians applied the name kakulah, which originally meant the fruit of some other plant which was used for flavouring bread. In the *Burhán* it is stated that the name *kakulah* is also given by some to a fruit like *sapandan* (a kind of cress), which is the same as *Ilachi.*

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Besides the two Indian cardamoms, there is a large kind of cardamom which comes from Ceylon, now found in commerce. Dr. Trimen, in his *Systematic Catalogue of the Flowering Plants and Ferns of Ceylon*, speaks of the plant which produces it as *Elettaria cardamomum*, Maton, *var. major*—the *Ensál* of the Singhalese.

As a masticatory and for flavouring food, the Malabar or small cardamom is preferred by the natives, but the other kinds, which are cheaper and of less delicate flavour, are largely used by the sweetmeat makers.

Cultivation.—There are two ways of propagating the plant, viz., by sets or by seed. The chief requirements for successful cultivation are a rich loamy soil, and a site sheltered from strong winds and too much direct sunlight. Clearings in forest land, with a few trees left here and there, in order to give the requisite shade and shelter, are found to offer the best conditions for the production of good crops. In the planting of sets, young ones of one to two years old should be chosen. Holes one foot deep and 18 inches wide are dug, and into these, after they have been prepared as beds, raised a few inches above the surrounding ground, the sets are inserted just below the surface of the soil.

The spaces between each plant may be from 6 to 12 feet, according to the quality of the soil. The ground should be well cleared of weeds, stones and rubbish, but when the plants have grown to a certain size, no further weeding will be necessary, as nothing will grow under their shade. Seeds should be sown in prepared nurseries, care being taken not to sow too deep. The seedlings, when 6 to 8 inches in height, should be transplanted and treated in the same manner as sets. (*Dict. Econ. Prod. Ind.* iii., p. 229). For the particulars of cardamom cultivation in the Wynaad, Travancore, Mysore, Madura, Coorg, and Canara, the same work may be consulted. To prepare cardamoms for the market, they are washed, bleached, and starched. For washing, 2 lbs. of pounded soapnuts and ¼ lb. of *Acacia concinna* pods are mixed with about

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5 gallons of water, and a separate solution of common country soap is made. Three quarts of the soapnut mixture are added to 8 quarts of water, and in this 10 lbs. of cardamoms are well agitated by hand and then transferred to a basket to drain for a few minutes. They are then washed a second time in 7 quarts of water, one of the soapnut mixture, and one of the soap solution, drained and thrown upon a mat. Then they are continually sprinkled with fresh water by relays of women until sunrise next morning, when they are spread out on mats to dry for four or five hours. The stalks are then cut off with scissors, at which work some women are so expert as to be able to nip 90 cardamoms in one minute. This done, the cardamoms are sorted for export. The starching process, which has only lately been introduced, consists in sprinkling the cardamoms with a thin paste made of rice and wheat flour, country soap, and butter milk, and rubbing them between the palms of the hands.

The washing mixtures are used for two lots of cardamoms and are then thrown away. The women who wash are paid 3 annas per diem; the night watchers 4 annas, and the nippers 2½ annas per 13 lbs.

Description.—The cardamom of commerce is a dry, three-sided, oblong, or roundish capsule of a yellowish-brown or dirty white colour. The pericarp is tough, and divides into three valves, from the middle of the inner surface of each a partition projects towards the axis, so as to divide the capsule into three cells, each of which is filled with closely packed angular seeds, each surrounded by a thin transparent membrane (aril). The seeds are of a rich brown colour, about two lines long, transversely rugose, with a depressed hilum, and deeply channelled raphé. The capsule is almost tasteless. The seeds have a pungent, camphoraceous, agreeable flavour, and leave a sensation of cold upon the tongue when chewed.

Microscopic structure.—The testa of the seed is formed of three layers: 1*st*, a layer of thick-walled striated cells; 2*nd*, a layer of large thin-walled cells; 3*rd*, an internal layer of dark-brown radiating cells, with very thick walls. The albumen is

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colourless and consists of polyhedral cells containing starch, and generally rhomboidal masses of albuminous matter, which can be easily seen when thin slices of the albumen in almond oil are examined by polarized light.

Chemical composition.—The parenchyme of the albumen and embryo is loaded with fatty oil and essential oil, the former existing in the seed to the extent of about 10 per cent. The essential oil, which amounts on an average to 4·6 per cent., has the odour and flavour of the seeds; it consists chiefly of a liquid having the formula $C^{10} H^{22} O^{3}$. According to Flückiger, the raw oil is dextrogyre, and deposits after a time a camphor, which he considers to be identical with common camphor, as it agrees with that substance in optical properties and crystalline form. The water which comes over when cardamoms are distilled, contains acetic acid. The ash of cardamoms, which, according to Warnecke, amounts to 6·12 per cent. in common with that of several other plants of the same order, is remarkably rich in manganese.

Commerce.—The trade in Indian cardamoms seems to have been declining for some years past. In 1880-81 the *exports* to foreign countries were valued at Rs. 8,20,257, but the returns for that year were the highest on record. For subsequent years they were as follows:—1883-84, Rs. 5,68,334; 1885-86, Rs. 5,60,012; and 1887-88, Rs. 2,04,858. In 1883-84, the United Kingdom received of the above, cardamoms to the value of Rs. 4,05,649, but last year only Rs. 52,658.

After the United Kingdom the other receiving countries are generally in the following order of importance:— Arabia, Germany, Persia. On the other hand, the *imports* of foreign cardamoms seem to be on the increase. In 1880-81 they were valued at Rs. 4,134, and taking the same years as have been given for the exports, the imports were in 1883-84, Rs. 18,351; 1885-86, Rs. 92,205; and 1887-88, Rs. 2,60,450.

During this year the bulk of the imports (*viz.*, Rs. 2,51,211 worth) came from Ceylon, and of the total of these foreign imports, Bombay received Rs. 2,16,455 worth. Of the internal

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trade in cardamoms, full statistics are not available, but excluding the transfrontier trade by land, it was last year valued at Rs. 25,11,053.

In Travancore the cardamom cultivation and trade are a monopoly of the State. The drug is grown on the Cardamom Hills, and is brought down, under guard, to Alleppy to be exported. The following table gives a Statement of the sale of Travancore cardamoms during the last sixteen years:—

Statement of the Sale of Travancore Cardamoms, 1875 *to* 1891.

Year M. E.	Cardamoms in candies of 600 E. lbs.	Average price per candy in Rupees.	Total amount realized.
		Rs.	Rs.
1051	275	838	2,30,268
1052	47	1,600	74,692
1053	133	1,719	2,28,526
1054	140	2,353	3,28,176
1055	248	1,966	4,87,596
1056	188	1,833	3,44,320
1057	158	1,427	2,25,855
1058	62	1,825	1,13,397
1059	303	1,018	3,08,601
1060	484	769	3,72,278
1061	148	682	1,01,101
1062	88	863	75,892
1063	256	492	1,26,058
1064	176	776	1,36,018
1065	84	590	49,787
1066	326	534	1,74,847

This table includes all cardamoms sold. Some will be exported by sea and some sent by backwater to Cochin, so

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what is sent to Cochin will also appear as exports from that Port.

The following notes have been kindly furnished by Mr. T. F. Bourdillon, Conservator of Forests, Travancore, late Superintendent of the Cardamom Hills:—

The cardamom plant is indigenous in the evergreen forest of Travancore, between the elevations of 400 and 4,000 feet, but thrives best at the higher of these altitudes.

The spice is divided into 3 classes: (1) *Magara ēlam*, or those cardamoms which ripen in the month of Magaram (January); (2) *Kanni ēlam*, those which ripen in the month of Kanni (September); and (3) *Nēēla ēlam*, or long cardamoms.

The first two classes grow on the same variety of the plant, the whole plant being smaller than that of the long variety, and the difference in the time of ripening is due to differences of altitude and climate.

The scapes on which the capsules are borne, in the case of the first two classes, always trail on the ground, whereas the scapes of the long cardamoms stand erect, and are often 2½ ft. high.

Magara ēlam are considered the best. The plants that produce them are grown at an elevation of 3,000 ft. and upwards on the eastern edge of the Travancore Territory, where the rainfall is comparatively light, reaching probably not more than 60 inches. In this comparatively dry district the capsules take longer to mature, and though the plant flowers in March and April, at the same time that it flowers elsewhere, the capsules do not ripen till January, and are considerably larger and contain more seed than the other kinds.

Kanni ēlam come second. The capsules are very round and sweet, but are smaller than those of the *Magara ēlam*. The plants which produce them grow at elevations between 1,000 and 2,500 ft., in a moister (100—200 inches) and more forcing climate than the others, and the fruit ripens more quickly.

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Nēēla ēlam come last. The plants are larger, and the scapes stand upright as already said. The capsules are long and less aromatic than those of the other two kinds. This variety is found on the hills of South Travancore, where the rainfall is heavy (150—200 inches) and where the sea breezes blow. The elevation is between 1,000 and 3,000 ft.

Although cardamoms are wild in the forests, they have been cultivated in gardens from time immemorial, and from old records it is seen that the oldest gardens which were in existence when Lieut. Ward made his survey of the country in 1817 are still the most productive. These gardens are found on the eastern edge of the Travancore hill-plateaux, where the *Magara ēlam* are produced, and this variety yields about ¾ of the total produce of the country. Some gardens are met with in the *Kanni ēlam* district, but these are more modern, and the yield is about ⅙ of the total crop each year. "Long cardamoms" are not grown in gardens; they are all collected wild from the forests.

When a person intends to open a garden, and has obtained permission to do so (for cardamoms are still a monopoly in Travancore), he selects some heavy forest, where there are already a few plants of cardamoms growing, carefully avoiding those places where reeds grow, as indicating poor soil. The common saying is that where the Anjili (*Artocarpus hirsuta*) and white cedar (*Dysoxylon malabaricum*) grow, there cardamoms will thrive.

The smaller trees and undergrowth are then cut down, only the larger trees being left to form a close canopy overhead. The garden is then kept clear of weeds by a cutting over and weeding twice a year, and cardamom seeds are sprinkled about, or the rhizomes are planted out when the plants have not come up properly. In about 3 years the garden begins to bear, and may continue to do so for upwards of a century if the light is not allowed to enter too much. Should any of the larger trees fall down and let the light in, the cardamom plants turn yellow and give a heavy crop, but then die out until shade has been again allowed to grow up.

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Each year when the cardamoms ripen, they are collected and dried on rocks, and when thoroughly dried they are delivered to the Cardamom Superintendent, who weighs them in and despatches the crop under escort to the Court, where it is sold, and the grower gets two-fifths of the price realised at the annual auction, the Government retaining the other three-fifths.

The crop yielded per acre is not large, and, indeed, a heavy crop is a disadvantage, as it would imply that the garden was about to die out. Equal crops of good full capsules are to be desired, and as the trees above drop their leaves and manure the plants below, no further manuring is necessary, though it is generally admitted that manuring would largely increase the crops were it feasible to carry out such operations.

It has been estimated that there are about 26,000 acres under cardamoms in Travancore, and 13,000 thulams (of 20 lbs. each) is a large crop. Even supposing that the area was much over-estimated, it is probable that the annual crop does not exceed 10 lbs. to the acre, though we have heard it placed at double that amount.

It will be seen by the figures quoted above that the crops of cardamoms in Travancore vary very considerably, the fact being that the setting of the blossom in March, April and May is very much dependent on the weather, frequent showers during those months being most favourable to a good crop, while a heavy monsoon is said to destroy the young fruit. Here too, as in the case of most fruit crops, a good year is followed by one or two bad ones and *vice versâ*.

Formerly, when Travancore used to supply the world with this spice, the price realized was very good, but since Ceylon and Curg cardamoms have come into the market, the price has fallen to about $\frac{1}{4}$ of its former level, so that the annual amount realized by the Government hardly pays for the establishment required to watch and guard the crop from being stolen. The owners of gardens, who are chiefly villagers from the adjoining district of Madura in British India, scarcely secure any return for their work, and it is now in contemplation to abolish the monopoly altogether.

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A considerable proportion of the cardamoms in Indian commerce consists of the seeds, without the husks. These seeds are obtained from overripe fruits which have burst in the field or during manipulation, and are of two kinds, Indian and Chinese. The latter are said to be the seeds of *Amomum xanthioides*. (*Hanbury, Science Papers*, pp. 100, 178, 250, 291.)

Amomum subulatum, *Roxb.*, is much larger than the true cardamom, of a dark-brown colour and coarsely striated, three-valved, each valve being furnished with three ragged, membraneous wings, which extend from the upper part of the fruit and gradually disappear towards the apex. The seeds are arranged as in the true cardamom, but are more numerous, and are held together in each cell by a dark viscid saccharine pulp. Their taste is aromatic and camphoraceous. They are much used in the preparation of sweetmeats on account of their cheapness. Value, Rs. 12 per maund of 37½ lbs.

The **Nutmeg Cardamom,** or true **Cardamomum majus,*** made its appearance in the Bombay market in 1885. Up to that time the only large cardamoms we have met with have been the Bengal or Ceylon kinds. Under the name of Hil-bawa it is correctly described by the Arabian physicians, who no doubt were acquainted with the genuine article. Persian and Indian writers are evidently not acquainted with it, although they copy the description given by the Arabs.

The *Pharmacographia* has the following account of this rare Cardamom:—"The true *Cardamomum majus* is a conical fruit in size and shape, not unlike a small fig reversed, containing roundish angular seeds, of an agreeable aromatic flavour, much resembling that of the Malabar cardamom, and quite devoid of the burning taste of grains of Paradise. Each fruit is perforated, having been strung on a cord to dry; such strings of cardamoms are sometimes used by the Arabs as rosaries. The fruit in question is called in the Galla language *Korarima*,

* Valerius Cordus, Hist. Plant. iv., 28; Mathiolus i., 27.

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but is also known as *Guragi* spice, and by its Arabic names of *Heil* and *Hab-el-habashi.* According to Beke, it is conveyed to the market of Báso (10° N. lat.), in Southern Abyssinia, from Tumhe, a region lying in about 9° N. lat. and 350 E. long.; thence it is carried to Massowah, on the Red Sea, and shipped for India (?) and Arabia. Von Heuglin speaks of it as brought from the Galla country. It is not improbable that it is the same fruit which Speke saw growing in 1862 at Uganda, in lat. 0°, and which he says is strung like a necklace by the Wagonda people.

ALPINIA OFFICINARUM, *Hance.*

Fig.—*Bentl. and Trim., t.* 271. The lesser Galangal (*Eng.*), Petit Galanga, Galanga de la Chine (*Fr.*).

Hab.—China. The rhizome.

Vernacular.—Kulinjan, Pán-ki-jer (*Hind.*), Shitta-rattai (*Tam.*), Kulinjan (*Mar.*), Kulanjan (*Guz.*), Kunjara-kathi (*Sind.*), Sannaelumparásh-trakum (*Tel.*), Kalanjan (*Can.*).

History, Uses, &c.—The Chinese call the Galangals *Kaon-leang-keang* and *Liang-keang.* From the first of these names the Arabs have derived their name Khulanjan or Khowlanján, which is applied to the greater and lesser galangal, and is the source of the European name for these drugs. The same name occurs in the Nighanta's, which makes it evident that the Hindus first became acquainted with Chinese galangal through the Arabs. The earliest notice of the drug occurs in Persian literature (cf. *Burhan*), where it is stated that Khusrú-dárú, "Chosros remedy," was introduced in the time of Noshirwan (6th century). It probably reached Persia by the Central Asian trade route, as we find that it is still used by the Tartars to flavour their tea. Paulus Ægineta (7th century) calls it γαλάγγας, and latter Greek writers χαιλίζεν, γαλάβκας and κολουτζία. Ibu Khurdádbah (9th century), in enumerating the productions of a country called Sila, names galangal, and Edrisi, three hundred years later, mentions it as brought from

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India and China to Aden. Ibu Sina and other early Arabian physicians also notice it shortly as a stomachic and stimulant. Curious stories as to its source were current in those days; Haji Zein states that in Yunán a kind of hawk is said by travellers to build its nest of the roots of the Khúlanján upon the sea-shore, and that the only way of obtaining the drug is to rob these nests; this the merchants do, and, after washing the roots, cut them up into short pieces.

Although this drug has been so long known, its botanical source was only discovered in 1870, when a description of the plant was communicated to the Linnean Society of London by Dr. H. F. Hance, made from specimens collected by M. E. C. Taintor near Hoihow, in the north of Hainan. (*Journal of the Linn. Soc.*, 1873, XIII., 6.)

Galangal is described by Serapion on the authority of Ishák bin Amrán as hot and dry in the third degree, useful to phlegmatic persons, and in humidity of the stomach; it promotes digestion by its heat and the solution which it occasions in the stomach, and thus relieves colic; gives fragrance to the breath, and warms the kidneys: it sets the semen in commotion, and when a piece of it is held in the mouth it occasions erections of the *membrum virile*. Other Arabian writers give a similar account of it. Indian Mahometan writers, with reference to the name Pán-kí-jar, say that the drug may be the root of very old plants of *Piper Betle*, but they are evidently in doubt about its being produced by that plant. (*Makhzan, article "Khúlanján."*) Mír Muhammad Husain describes Galangal as tonic, stomachic, carminative, stimulant, and aphrodisiac. He tells us that if given to young children it makes them talk early, and that a paste of the powdered drug made with oil or water will remove freckles. It is a stomachic tonic, used by native practitioners to reduce the quantity of urine in diabetes. It is used to correct foul breath when chewed, and the juice swallowed stops irritation in the throat. (*Emerson.*) Galangal is one of the ingredients of Warburg's tincture. It is not used in English medicine, but there is a considerable demand for it in Russia, where it is

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used for a variety of purposes, as for flavouring the liqueur called *Nastoika*, it is also employed by brewers, and to impart a pungent flavour to vinegar, a use noticed by Pomet so long ago as 1694. As a popular medicine and spice, it is much sold in Livonia, Esthonia, and in Central Russia. It is also in requisition as a cattle medicine, and all over Europe there is a small consumption of it in regular medicine (*Hanbury*). Irvine (*Med. Topog. of Ajmeer*, p. 171) says that the natives add Kulijan to bazar spirit to make it more intoxicating.

Description.—The dried rhizomes are about as thick as the little finger or often less. They have evidently been cut into short lengths (2 to 3 inches) while fresh; many of the pieces are branched, and all are marked by numerous circular ridges of a light colour. The external surface of the rhizome is of a deep reddish-brown, the interior pale red, hard and tough; the odour is aromatic and the taste hot and spicy.

Microscopic structure.— The bulk of the rhizome consists of a uniform parenchyma traversed by fibro-vascular bundles, some of the parenchyme cells are full of resin and essential oil, but most of them contain large starch grains of an elongated or club-shaped form.

Chemical composition.— Galangal contains from $\frac{1}{4}$ to $\frac{1}{2}$ per cent. of an essential oil, which is the odorous principle; according to Vogel, its formula is $C^{10}H^{16}O$. Brandes extracted from Galangal with ether a neutral, inodorous, tasteless, crystalline body, *Kæmpferide*. E. Jahns (1883) has isolated the following compounds from the root: *Kämpherid*, $C^{16}H^{12}O^6H^2O$, crystallizing in yellowish needles (m. p. 221°), which are slightly soluble in water, ether and benzine, freely soluble in alcohol, soluble in alkalies to an intensely yellow solution, and in concentrated sulphuric acid to a yellow solution with a strong blue fluorescence. *Galangin*, $C^{15}H^{10}O^5H^2O$, crystallizing from its solution in aqueous alcohol in yellowish-white needles (m. p. 214°). The reactions of this body are very similar to those of kampherid; its solution in concentrated sulphuric acid, however, is non-fluorescent.

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Alpinin, $C^{17}H^{12}O^{6}$, crystallizes in yellowish needles (m. p. 173°). Its reactions are similar to those of galangin. (*Archiv. der Pharm.*, CCXX., 161; *Year-Book of Pharmacy*, 1882, p. 199.) The resin, which is probably the acrid principle, has not been examined.

Dr. Thresh (1884) has isolated from Galangal root an active pungent principle, which he has named *Galangol*, and which resembles the pungent principles of Ginger, Capsicum, and grains of Paradise in certain respects. He records the following proximate analysis of 100 parts of the rhizome:—Volatile oil 0·6, resin 0·2, fat and *Galangol* 1·6, kampferid, &c., 1·4, other saline matters soluble in ether but not precipitated by Pb. A^2 1·2, tannin 0·6, phlobophane 1·2, other substances soluble in alcohol 3·2, glucose, mucilage, &c., 3·5, oxalic acid 0·3, galangal red 2·8, starch 23·7, albuminoids 2·6, moisture 13·8, ash 3·8, cellulose, &c., 39·5. The active principle could not be isolated in a state of purity.

Commerce.—The imports of Galangal into India average 3,300 cwts. yearly. In 1883-84 they amounted to 3,870 cwts., valued at Rs. 35,982, of which Calcutta took 686 cwts., Bombay 1,750 cwts., and Madras 1,434 cwts. Of the total imports 1,230 cwts. came from Hongkong, 2,540 cwts. from the Straits Settlements, and 100 cwts. from other countries. During the same year 1,670 cwts. were re-exported to Arabia and Persia.

Galangal is valued in Bombay at about Rs. 3½ per maund of 37½ lbs.

ALPINIA GALANGA, *Willd.*

Fig.—*Rumph. Amb. v., t.* 63. The greater Galangal, Java Galangal (*Eng.*), Galanga grand, Galanga de Java (*Fr.*).

Hab.—Java, Sumatra, Southern India. Cultivated in Bengal. The rhizome.

Vernacular.—Bara-Kulinjan (*Hind.*, *Guz.*), Motha-kolanjan, Kosht-kolanjan, Malabari-kolanjan (*Mar.*), Pera-rattai (*Tam.*), Pedda-dumparash-trakan (*Tel.*), Pera-ratta (*Mal.*).

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History, Uses, &c.—The great Galangal is known in China by the same names as the lesser Galangal, and does not appear to have been distinguished from the latter drug by the Greeks, Arabs or Persians. Hanbury (*Science Papers*, p. 373) remarks that Garcia D'Orta was the first writer to point out (1563) that there are two kinds of Galangal—the one, as he says, of smaller size and more potent virtues, brought from China, the other, a thicker and less aromatic rhizome, produced in Java. Loureiro describes the plant which produces it under the name of *Amomum Galanga*, and gives Câo Leâm Kiâm as its name in Cochin-China. Roxburgh (i., 60) fully describes the plant grown in Calcutta from roots sent to him by Dr. Charles Campbell from Bencoolen, and quotes a note by Mr. Colebrooke to the effect that the roots are the Kulanjana of the Raja Nirghanta, and the Sughanda-vacha and Malabari-vacha of the Bhavaprakasha. From the latter name it appears that the Hindus regard the plant as a native of Malabar or of Western India; the correctness of this opinion has been confirmed by Dalzell and Gibson, who found it growing truly wild upon the Wagh Dongar or "tiger hill" in the Southern Concan. (*Bomb. Fl.*, p. 274.) The root of the Indian plant does not, however, appear to have been collected for commercial purposes until a comparatively recent date, which has given rise to the supposition that the plant is not a native of India. At the present time it is cultivated both in Malabar and Bengal.

The fruits of *A. galanga* furnish the Galanga Cardamom. In the fresh state they are of the size of a small cherry, obovate, smooth, and of a deep orange-red colour. Hanbury (*Science Papers*, p. 252) describes the dried fruit (*Kaon-leang-keang-tsze*, Chinese) as about half an inch in length, of an oblong form, somewhat constricted in the middle, or occasionally pear-shaped; some obscurely 3-sided. Each fruit prominently crowned with the remains of the calyx; in a few the lower extremity still attached to a slender pedicel. Most of the capsules much shrivelled on the outside, a few plump and smooth. Pericarp from pale to deep reddish-brown, glabrous, thin. Seeds united in a 3-lobed mass, completely invested in

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a whitish integument, each cell or lobe containing usually two, placed one above the other; these are ash-coloured, flattish, and somewhat 3-angled, finely striated, and have a pungent taste like that of the root. (*For figure, see Science Papers*, p. 107.)

The root is readily distinguished from that of *A. officinarum* by its larger size, feebler odour and taste, orange-brown exterior and yellowish-white interior. The statistics of Indian commerce do not enable us to distinguish this drug from China galangal.

It is valued in Bombay at about Rs. 50 per candy of 7 cwts. Galangal cardamoms are not found in Indian commerce.

In the Kew *Bulletin* for January 1891 (p. 5) an interesting account is given of the identification of the plant yielding the rhizome employed to make the well-known Chinese preserved ginger. As long ago as 1878, Dr. E. Percival Wright, of Trinity College, Dublin, called the attention of Mr. Thiselton Dyer to the fact that the preserved ginger has very much larger rhizomes than *Zingiber officinale*, and that it was quite improbable that it was the produce of that plant. The difficulty in identifying the plant arose from the fact that, like many others cultivated for the root or tuber, it rarely flowers. The first flowering plant was sent to Kew from Jamaica by Mr. Harris, the Superintendent of the Hope Garden there. During the past year the plant has flowered both at Dominica in the West Indies and in the Botanic Garden at Hongkong. Mr. C. Ford, the Director of the Botanic Garden at Hongkong, has identified the plant as *Alpinia galanga*, the source of the greater or Java galangal root of commerce. Mr. Watson, of Kew, appears to have been the first to suggest that the Chinese ginger plant is probably a species of *Alpinia*, and possibly identical with the Siam ginger plant, which was described by Sir J. D. Hooker in the *Botanical Magazine* (tab. 6946) in 1887 as a new species, under the name of *Alpinia zingiberina*. Mr. J. G. Baker, in working up the Scitamineæ for the 'Flora of British India,' arrived at the conclusion that it is not distinct from the *Alpinia galanga*,

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Willd. The Siam and Chinese gingers are therefore identical, and both are the produce of *Alpinia galanga*, Willd. *Pharm. Journ.*, Jan 31st, 1891.

MUSA PARADISIACA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 275; *Rheede, Hort. Mal. i. tt.* 12—14. Plantain (*Eng.*), Bananier (*Fr.*).

Hab.—Cultivated throughout India. The fruit, leaves and stems.

Vernacular.—Kéla (*Hind., Guz.*), Kala (*Beng.*), Kél (*Mar.*), Vazhai-pazham (*Tam.*), Anati-pandu, Amti-pandu (*Tel.*), Báli (*Can.*).

History, Uses, &c.—The cultivated plantains are called Kadali in Sanskrit, and the wild plantains, which, we believe, to be their progenitors, Aranya-kadali and Rambhà. There are many synonyms, such as Bhánuphala or Ansumatphala "having luminous fruit," Cháruphala "having delicious fruit," Rájeshta "liked by kings," Vana-lakshmi "beauty of the woods," &c. We think there can be little doubt that the plantain has been under cultivation in India from prehistoric times. The Greeks under Alexander must have become acquainted with it; Theophrastus and Pliny describe a tree called *Pala*, with leaves like the wing of a bird, three cubits in length, which puts forth its fruit from the bark, a fruit remarkable for the sweetness of its juice, a single one (bunch?) containing sufficient to satisfy four persons; this tree is supposed to have been the plantain. The word *pála* signifies "leaves," but we are not aware of its ever having been applied to the plantain. The Arabs call it *Mauz* and *Talk*, and under the latter name it is mentioned in the Koran—و اصحاب اليمين ما اصحاب اليمين* فى سدر مخضود و طلع منضود (and the companions of the right hand, happy companions of the right hand among Lotus trees free from thorns, and plantains with their lapping clusters of fruit).

Under the name of Mauz, Mesne describes the fruit as useful in soreness of the throat and chest with dry cough, and in

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irritability of the bladder; he considers it to be aphrodisiac, diuretic and aperient, and recommends it to be cooked with sugar or honey. Eaten in excess it gives rise to indigestion. Abu Hanifeh in the 9th century described very accurately the manner of growth of the plantain, and quotes a saying of Ash'ab, to his son, as related by As, "Wherefore dost thou not become like me?" to which he answered, "Such as I is like the *Mauzah*, which does not attain to a good state until its parent dies." (*Madd-el-kamus.*) The early Italian travellers called the plant *Fico d'Adamo*, and thought they saw in the transverse section of the fruit a cross or even a crucifix. Mandeville calls it the Apple of Paradise. The varieties of the plantain are very numerous; Rumphius describes sixteen (*Herb. Amb.*, viii., 2). Some of these, like the large yellow *Manyel*, are only used after they have been cooked; others, as the *Icláhi*, are small and delicate in flavour. The abortive flowers at the end of the spike are removed and used as a vegetable by the Hindus, and the unripe fruit, called *Mochaka* in Sanskrit, is used medicinally on account of its astringent properties in diabetes; it is made into a *ghrita* with the three myrobalans and aromatics. Young plantain leaves are universally used as a cool dressing for blisters and to retain the moisture of water dressings; they serve also as a green shade for the eyes. Emerson notices the use of the sap to allay thirst in cholera. Mír Muhammad Husain in the *Makhzan* tells us that the centre of the stem, *Kanjiyál*, is eaten with fish as a vegetable in Bengal, that the kind called *Málbhok* is used as a poultice to burns, and that called *Bolkad* is boiled and used as an ointment to the syphilitic eruptions of children; he also notices the use of the ashes on account of their alkaline properties, and of the root as an anthelmintic. MM. Corre and Lejanne state that the fruit stems sliced and macerated in water all night, yield a sudorific drink; and that the charcoal of the skin of the fruit is recommended by Chevalier as an application to the cracks in the sole of the foot from which Negroes suffer. Pereira (*Mat. Med.*, ii., p. 222) has drawn attention to the nutritive properties of the meal prepared from the fruit. In India the lower

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portion of the stem of the wild plantain is a valuable resource in famine seasons on account of the large quantity of starch it contains. Starch prepared from the unripe fruit is used in the treatment of bowel complaints in Bengal. A specimen we examined consisted almost wholly of pure starch, with a trace of astringent extractive. In America a syrup of bananas is said to be singularly effective in relieving chronic bronchitis. The preparation is simple, requiring only that the fruit shall be cut in small pieces and with an equal weight of sugar be placed in a close jar, which is set in cold water and slowly heated to the boiling point, when it is to be removed from the fire and allowed to cool. The dose mentioned is a teaspoonful every hour.

Chemical composition.—Professor Johnston, in the *Journal of the Agricultural Society of Scotland*, says: "We find the plantain fruit to approach most nearly in composition and nutritive value to the potato, and the plantain meal to that of rice. Thus the fruit of the plantain gives 37 per cent., and the raw potato 25 per cent., of dry matter. In regard to its value as a food for man in our northern climates, there is no reason to believe that it is unfit to sustain life and health; and as to warmer or tropical climates, this conclusion is of more weight." The only chemical writer who had previously made personal observations upon this point (M. Boussingault), says: "I have not sufficient data to determine the nutritive value of the banana, but I have reason to believe that it is superior to that of the potato. I have given as rations to men employed at hard labour about 6½ pounds of half-ripe bananas and two ounces of salt meat." Of these green bananas he elsewhere states, that 38 per cent. consisted of husk, and that the internal eatable part lost 56 per cent. of water by drying in the sun. The composition of the ash of the plantain also bears a close resemblance to that of the potato. Both contain much alkaline matter, potash and soda salts; and in both there is nearly the same percentage of phosphoric acid and magnesia. The growing parts of the plant contain much tannic and gallic acids. The sound ripe fruit contains as much as 22 per cent. of sugar, 16 per cent. being crystallizable. In the native sugar-cane the

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proportion of cane sugar, according to Payen, is 18 per cent. After the plantain has become quite ripe, there is a rapid diminution in the proportion of crystallizable sugar and an increase in the proportion of inverted sugar; an over-ripe fruit contained only 2·84 per cent. of crystallizable and 11·84 per cent. of uncrystallizable sugar, being a total of 14·68 per cent. or two-thirds of the original quantity.

For the following analyses of E. Indian plantains we are indebted to Assistant Surgeon C. L. Bose, Calcutta. The samples represent the most commonly used varieties:—

Percentage of Pulp and Pericarp in Ripe Fruit.

Variety.	Pulp.	Pericarp.
Kantali	70·85	29·15
Champa	74·37	25·63
Chattim	86·02	13·98

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Percentage Composition of Pulp.

Variety.	H_2O.	Ash.	Alkalinity of Ash in terms of Normal KHO.	Cane Sugar.	Grape Sugar.	Total Sugar.	Gum.	Total acidity of Pulp in terms of Normal NaHo.	Fat.	Total N.	Albuminoids, N × 6·25.	Non-nitrogenous extractives by difference.
Kantali	67·68	·77	7·09 c. c.	8·36	7·75	16·11	·48	8·90 c. c.	·058	·2	1·35	13·657
Champa	71·47	·97	8·08 c. c.	...	...	14·15	·401	7·87 c. c.	·135	·288	1·80	11·109
Chattim	73·32	·73	7·34 c. c.	10·37	7·41	17·78	·36	4·57 c. c.	·00	·24	1·50	6·31

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König gives the following as the composition of the fruit from Brazil and Venezuela—the first analysis being by Corenwinder, and the other by Marcano and Müntz :—

	Brazil.	Venezuela.	Mean.
Water	72·40	73·8	73·10
Albuminoids	2·14	1·60	1·87
Fat	·96	·30	·63
Nitrogen free extractive	23·09	23·00	23·05
Cellulose	·38	·20	·29
Ash	1·03	1·10	1·06

The fruit consisted of about 40 per cent. pericarp and 60 per cent. pulp. The pericarp afforded 14·7 per cent. of solid residue, containing 1·6 per cent. of grape sugar. The anhydrous fruit from Brazil contained 1·24 per cent. nitrogen and 83·66 per cent. carbohydrates; that from Venezuela, ·97 per cent. nitrogen and 87·78 per cent. carbohydrates. Plantain meal from Venezuela had the following percentage composition :—

Water	14·90
Albuminoids	2·90
Fat	·50
Nitrogen free extractive	77·90
Cellulose	1·60
Ash	2·20

The nitrogen free extractive from the ripe fresh fruit and meal had the following composition :—

	Brazil.	Venezuela.	Meal.
Cane sugar	15·90	5·90	1·52
Grape sugar	8·50	6·40	3·30
Starch	·60	·40	66·10

The ash of the fruit from Brazil had the following percentage composition :—Potassium sulphate, 3·61; Potassium chloride, 14·34; Magnesium phosphate, 8·77; Potassium oxide, 27·12; Potassium carbonate, 41·66; Calcium carbonate, 1·17; Oxide of iron, ·36; Sand, 2·06 per cent.

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The ash of the husk of the ripe fruit was found to contain 47·98 carbonate of potash, 6·58 carbonate of sodium, 25·18 chloride of potassium, 5·66 alkaline phosphates (with a little sulphate), 7·50 charcoal, 7·10 lime, silica, earthy phosphates, &c. In the juice of the flower stem of the same plant, Comnille (*J. Pharm.* (3) 43, 269) found 25·27 per cent. potash, 9·52 soda, 15·85 lime, 5·0 magnesia, 0·87 alumina, with a trace of ferric oxide, 6·30 chlorine, 0·96 sulphuric anhydride, 0·87 phosphoric anhydride, 0·81 silica, and 34·17 carbonic anhydride (calculated from the bases).

Commerce.—Dried plantains are an article of commerce in India, and are excellent when stewed with sugar or fried in butter. Bombay exports annually from 300 to 400 cwts.

CANNA INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. xi., t.* 43. Indian Shot or Bead (*Eng.*), Balisier (*Fr.*).

Hab.—Uncertain. Common throughout India in gardens and cultivated ground. The fruit and root.

Vernacular.—Sabba-jaya, Akalbar (*Hind.*), Sarba-jaya (*Beng.*), Kandámani-cheddi (*Tam.*), Krishna-tamara (*Tel.*), Kátú-búla (*Mal.*), Sugundaraju-gida (*Can.*), Deokeli, Kámákshi (*Mar.*).

History, Uses, &c.—This plant, though common everywhere, is not truly wild in India; how and from whence it has been introduced is not known; it occurs also in Burma and Ceylon, and the seeds are used as prayer-beads by the Burmese. In the West Indies, especially in St. Kitts, a nearly allied species is cultivated for its starch, which is known as "*Tous les mois*" or "*Fécule de Tolomane,*" and is remarkable for the great size of its starch grains. No starch is prepared in India from *C. indica*, but its fruit and root are used medicinally by the natives. The flowers are sacred to Shiva and Durga, as is indicated by the Hindi, Bengali, and Marathi names which are derived from the Sanskrit Sarva-jaya "all conquering" (Shiva), and Kámákshi, a name of the goddess Durga. In the *Dict. Econ. Prod. of India,*

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the Sanskrit name Silarambha is wrongly attributed to this plant, it is properly the name of the wild plantain or Káshtha Kadali. Rheede, describing the medicinal uses of *C. indica*, says:—"E fructibus parvum tostis succus elicitur, qui auribus immissus dolores illarum mitigat. Ex iisdem et saccharo massa componitur, et umbilicali regioni applicatur contra diabetem, ex calidis febribus ortam. Succus radicis Mercurii sublimati toxicum infringit." Atkinson (*Him. Dist.* 730) states that the root is used as a diaphoretic and diuretic in fevers and dropsy. When cattle have eaten any poisonous plant, which is generally discovered by the swelling of the abdomen, the natives administer to them the root of this plant, which they break up in small pieces, boil in rice-water and pepper, and give them to drink. (*Drury.*) Baden-Powell (*Punj. Prod.* 382) states that the seeds are considered to be cordial and vulnerary.

Description.—An herbaceous plant, 2-3 feet; leaves large, ovate-lanceolate, stem-clasping; flowers bright scarlet or yellow, inner wing of the corolla trifid, segments lanceolate, straight; anther single, attached to the edge of the corolla; capsule bristly, 3-celled, many-seeded; seeds round, black, hard and shining, the size of a pea or buck-shot.

Chemical composition.—The seeds reduced to powder were exhausted with alcohol, and the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, then with ether, and after the addition of an alkali, again with ether.

The petroleum ether extract contained yellowish fatty matter, from which white nodules separated on standing, the taste was camphoraceous and somewhat pepper-like. The acid ether extract had the odour of vanilla; it was partly soluble in water with acid reaction, the aqueous solution giving a bright green coloration with ferric salts, slightly precipitating gelatine, but giving no reaction with potassic cyanide.

No alkaloidal principle was detected in the ether extract, the amount of which did not exceed a trace.

The fresh roots were contused, and treated in the same manner as the seeds. The taste of the alcoholic extract was

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slightly pungent with a flavour of ginger. The petroleum ether extract was yellow and consisted of resinous and fatty matters; it was partly soluble in absolute alcohol, the solution giving a dirty-green precipitate with ferric chloride. The acid ether extract was partly soluble in water, and the solution gave a sage-green coloration with ferric chloride, precipitated tannin, but gave no reaction with potassic cyanide. The portion insoluble in water was nearly wholly soluble in ammonia, affording a deep yellowish-brown solution, from which acids precipitated yellowish flocks. The alkaline ether extract contained traces of an alkaloid which failed to afford any special colour reactions.

The seeds have been stated by Dalzell and Gibson (*Bombay Flora*) to afford a beautiful but evanescent dye; we failed to detect the presence of any such dye principle in either the seeds or roots. The roots contain mucilaginous matter and starch; starch was also present in the seeds.

IRIDEÆ.

IRIS GERMANICA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 670; *Bot. Reg.*, *t.* 818. Orris root (*Eng*)., Racine d'Iris (*Fr.*).

Hab.—Central and Southern Europe, Northern India, and Persia. The rhizome.

Vernacular.—Bikh-i-banafshah, Keore-ka-mul (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. II., p. 296) that we consider Orris root to be the Pushkara-mula of Sanskrit writers, though it is not now recognised as such by the modern Hindus. It appears also to be the Kusht-el-bahri and Kusht-el-hali, "sweet costus," of the Arabs. The Greek name Iris is probably of Persian origin, and cognate with Aersa, and probably with Arastan, an old form of Árástaṇ, "to adorn, to obey." Among Sanskrit synonyms for Pushkara-mula, we find Padma-pushkara "blue lotus," Pushkaránghrija "born of the lotus root," Pushkaráhva "challenging the

lotus," Pushákarasgara "sea lotus," and Kasmira "Cashmerian": at the present time *I. nepalensis* is called "blue lotus" in Kumaon. The root is described as having properties similar to costus, and appears to have been regarded by both Hindus and Arabs as a kind of costus. In the Burhán the plant is said to be called Irsa, because its flowers are blue, yellow and white like the rainbow; it is also called in Persia Susán-i-asmánguni, "sky-coloured lily." The Iris is mentioned by Theophrastus (H. P. iv., 7; ix. 7), Dioscorides (i., 1), and all the Greek medical writers which we have consulted. A celebrated unguent, the ἴρινον μύρον, was prepared from the root for which Macedonia, Elis and Corinth were famous. Visiani (*Fl. Dalmat.*) considers that the *I. germanica* is the Illyrian iris of the ancients, which is highly probable, seeing that throughout Dalmatia (the ancient Illyricum) that species is plentiful, and *I. florentina* and *I. pallida* do not occur. According to Hooker, *I. germanica* is cultivated in Cashmere, but we have not heard of its being under cultivation in Persia. The Persian name of this drug, Bikh-i-banafshah, is applied also to the root of *Viola odorata* in Southern India.

Iris root is considered by Mahometan hakíms to be deobstruent, aperient, diuretic, especially useful in removing bilious obstructions. It is also used externally as an application to small sores and pimples. From the large number of diseases in which this drug is recommended, it would appear to be regarded as a panacea.

Description.—Eastern orris root differs from the European drug, inasmuch as the bark of the rhizome has not been removed; it is also smaller and of a darker colour.

Microscopic structure.—The rhizomes of different species of Iris hardly differ in structure. They consist of a brown epidermis composed of compressed and nearly empty cells, covering a white cortical cellular tissue containing starch; this is separated by a layer of brownish compressed empty cells from the central woody yellowish tissue of the rhizome. The latter is built up of large thick-walled, spherical, porous cells,

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loaded with starch; here and there between the cells may be seen a prism of oxalate of lime. The vascular bundles are numerous, in each irregular rings of spiral vessels surround a central bundle of jointed vessels.

Chemical composition.—The authors of the *Pharmacographia* say:—"When Orris root is distilled with water, a solid crystalline substance, called *Orris Camphor*, is found floating on the aqueous distillate. This substance, which we obtained from the laboratory of Messrs. Herrings & Co., of London, is yielded, as we learn from Mr. Umney, to the extent of 0·12 per cent., that is to say, 3 cwt. 3 qrs. 23 lbs. of rhizome afforded of it 8½ ounces. Messrs. Schimmel & Co., of Leipzig, also presented us with the same substance, of which they obtain usually 0·60 to 0·80 per cent. Orris camphor has the exquisite and persistent fragrance of the drug; we have proved that this presumed stearoptene or Camphor of Orris root consists of *myristic acid*, $C^{14}H^{28}O^{2}$, impregnated with the minute quantity of essential oil occurring in the drug. The oil itself would appear not to pre-exist in the living root, but to be formed on drying it.

"By exhausting Orris root with spirit of wine, a soft brownish resin is obtained, together with a little tannic matter. The resin has a slightly acrid taste; the tannin strikes a green colour with persalts of iron."

Commerce.—India is supplied with Orris root from Persia and Cashmere. The average value is about 2 annas per lb.

CROCUS SATIVUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 274; *Woodv.*, *t.* 259; *Royle, Ill.*, *t.* 90. Saffron (*Eng.*), Saffran (*Fr.*).

Hab.—Greece, Asia Minor, Persia. Cultivated elsewhere. The stigmas with portions of the styles.

Vernacular.—Késar (*Hind.*), Késhar (*Mar.*, *Guz.*), Jáfrán (*Beng.*), Kunguma-pu (*Tam.*), Kunkuma-puvva (*Tel.*), Kunkumadahuvu, Késari (*Can.*), Kunkuma-puvva (*Mal.*).

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History, Uses, &c.—Saffron, on account of its brilliant yellow colour, like that of the rising sun, has been especially valued by mankind from the earliest ages; in Sanskrit it bears the name of Kunkuma (a name also given in India to the red colour prepared from turmeric), and is described as Charu "fair," Vara "suitor," Agnisikha "having a crest of fire," Saurabha "fragrant," Mangalya "propitious," &c. In Persia the word *Zard*, derived from the Zend, signifies "yellow, and saffron," and the sun is called *Zard-ru* "yellow or golden-faced," and Zardah-i-kamrán "the fortunate yellow." Saffron is the Karkôm of the Hebrews, a name borrowed from the Persians, and in the *Song of Solomon* the beauty of the bride is likened to it. Amongst the Greeks κροκος signified both saffron and yellow; *Eos* or Aurora, the goddess of the morning, is clothed in it, and in Homer she is described as accompanying the Sun throughout the day.

Yellow, and plants having that colour, have also an erotic signification, hence we find them playing an important part in marriage ceremonies and the relations between the sexes: Juno in the *Iliad* is represented as preparing a bed of saffron and hyacinths when she wishes to tempt Jove, and Jayadeva in the *Gita Govinda* represents Hari as inviting Radha to repose upon a bed made of the saffron-coloured flowers of the Asoka. The following lines indicate the significance which is attached to this colour in popular estimation in India:—

> Sánjh suni piyá ávan piyári, sundar nári singár banái,
> Piar kesar, piar besar, piar hár liya larkái,
> Piar chir diyo kamlápati, piar chandan de lagái,
> Piar pán ki biri lagi, piyári piri bhai, piu nahin ái.

"The loved one heard that her lover would come in the evening, and made a grand toilette: yellow saffron, a yellow nose-ring, and a threaded necklace of yellow flowers. She has donned a yellow robe, applied yellow sandalwood, and placed ripe yellow betel leaves in her mouth. The damsel herself has grown yellow waiting for a lover who has not come."

The Grecian Hetairæ and also effeminate youths used to wear the κροκωτος, or "saffron-coloured garment," and the Arabs

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relate that Abu Jahl dyed his است (*ist*) with saffron, and was addicted to the enormity, termed ابنة (ubnah). He was a great enemy of the Prophet's, and is promised in the Koran a taste of Hell (و نذيقه يوم القيامة عذاب الحريق). A similar use of saffron by the libidinous old witch Zatel-Dawahi is mentioned in the 93rd night of the *Arabian Nights* :—وكان اكثر اقامتها عند ولدها حردوب ملك الروم لاجل الجوارى الابكار لانها كانت تحب السحاق وان تأخرعنها تكون في انمحاق وكل جاريه اعجبتها تعلمها الحكمة وتسحق عليها الزعفران فتغشى عليها من فرط اللذة مدة من الزمان

Magic properties are ascribed to saffron in Persia; Haji-Zein-el-Attár (1368) states that it is called Jádú-i-dihkán, "peasant's magic," and that pregnant women wear a ball of it, about the size of a walnut, at the pit of the stomach to ensure speedy delivery and expulsion of the after-birth. The saffron bag was not unknown in Europe in the Middle Ages, and even later. The Arabs believe that saffron kept in the house will drive away the lizard called *Sam Abras*, which they greatly dread; they also say of a man who is melancholy or a little odd انه لفى صفره (innahu lafi sufrihi), *i.e.*, that he is in a state in which he requires to be rubbed with saffron.

Zardáb, or saffron water, is considered to have magical virtues in Persia, and we hear Indian conjurors ascribe the same virtues to turmeric water when they say *Pihalad áni ho gora* in the sense of "Hocus Pocus," &c. Saffron ink is used in India to write *Mantras* with. That auspiciousness is attributed to these plants on account of their colour, and not on account of any inherent properties, is shown by the fact that other plants furnishing yellow dyes are considered auspicious. In Persia *Delphinium Zalil* is much esteemed as a yellow dye, and is even brought to India for that purpose, where it bears the Sanskrit names of Tráyamána "preserving," Mangalya "auspicious," &c. It is quite possible that this plant was used in ancient Iran before saffron, as the word *tráyamána* occurs in old Persian with the meaning of "yellow." Dr. Aitchison speaks of *D. Zalil* as very common in Khorasan, and remarks that when in flower it gives a wondrous golden hue to the pastures.

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A yellow colour is considered most auspicious in the East. Vasanta, or Spring, and Krishna are represented as clothed in this colour, and Vasanti-coloured garments are worn at the *Basant panchami* in many parts of India; at this season also garlands of yellow flowers are offered. This custom is alluded to in the *Báramása*, where the wife says:—

> Nahín ghar kanth, leke basant ai ghar málan,
> Main kaise púján, sakhi, nahin ghar sájan.

"My husband is away, and the gardener's wife has brought (yellow) spring flowers. How can I make an offering, my dear, when my beloved is absent?"

A yellow garment, called *Basanti,* was worn by the Rajputs when about to sacrifice themselves in a desperate conflict, a sacrifice to their supposed ancestor Surya (the sun). Yellow is the favourite colour of the Buddhists, and the Sakya family was a branch of the great Solar race of Gautama. Sénart considers that the Buddha is the Sun-god, and that the details of his life have been taken from Solar mythology.

The use of saffron and turmeric for colouring and flavouring food is universal throughout India, and saffron is still used for this purpose in Germany, Switzerland, and in Cornwall, cakes made on festive occasions being coloured with it. There is a curious story about saffron-coloured rice in the Persian *Burhán,* where it is called Birinj-i-shamálah, "candle rice." The author relates that in former times there was a cook at Shiraz, who was in the habit of sitting by the roadside every evening and preparing a dish with yellow rice, before which he lighted two lamps, or sometimes two torches, and cried out—"Come to the rice of the candle," and repeated the following couplet:—

این شمعها که در دل بسحاق برفروخت از رهگذار نور برنج شماله بود

"The lights which burnt in the heart of Bushák were kindled by the passing of the light of the rice of the candle."

Who was Bushák, or Bashák? We cannot help thinking that he must have been some sturdy fire-worshipper testifying, as far as he dared, in the presence of a Mahomedan population, to his ancient faith. As the story was an old one when the

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Burhán was written, it shows at any rate that the use of saffron-coloured rice in Persia is of great antiquity. The earliest European travellers in India called turmeric *Crocus indicus*, "Indian saffron," and evidently regarded it as a substitute for that article. In those days saffron was of much more importance in Europe than it is now, and the punishment for adulterating it was death.

Saffron was much employed by the Romans for seasoning food, and to make an essence with wine and water which was used as a perfume (*Pliny*, 21, 6, 17; *Lucretius*, ii., 416; *Ovid A. A.* 104, &c.). The name *Záfarán* occurs in the *Siháh* of El Jowhari who wrote in the 10th century, and from Arabian writers (Istakhri, Edrisi) we learn that it was cultivated at this time in Persia at Darband and Ispahán. It is not improbable that the plant was carried from that country to China, as, according to the Chinese, it was introduced by Mahometans. Chinese writers have recorded that under the Yuen dynasty (A. D. 1280—1368) it became the custom to mix Sa-fa-lang (Záfarán) with food (*Bretschneider, Chinese Botanical Works*, Foochow, 1870). Saffron appears to have been cultivated in Spain in the 10th century. The *Rája Nirghanta*, which was written about 600 years ago by a native of Cashmere, speaks of saffron as coming from Cashmere, and the plant is still cultivated there on the Kareewahs* near Pampur; the plants are arranged in parterres, and flower about the end of October; the inhabitants of the district are then summoned to gather the crop; during this time they live in the gardens which are guarded by police to prevent theft (*Ince, Handbook of Cashmere*).

The earliest medical writers mention saffron, and describe it as cardiacal and aphrodisiacal, improving the complexion, increasing the brilliancy of the eyes, and promoting the delivery of women. They also considered it to be diuretic, astringent, deobstruent, and emmenagogue. Saffron, formerly as highly

* Alluvial flats from 100 to 200 feet high and 2 to 5 miles long, situated along the borders of the Cashmere Valley; they are separated from each other by deep ravines, and have the appearance of flat-topped hills.

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esteemed in Europe as in the East, is still considered by some European physicians to have emmenagogue properties, but is generally regarded as a colouring and flavouring agent only. Saffron has recently been deleted from the drug list of the Medical Store Depôts in Bengal. For much interesting information concerning the early history of saffron in Europe, we would refer our readers to the *Pharmacographia* of Flückiger and Hanbury.

Description.—Saffron consists of a small portion of the style and three long tubular stigmas of a rich orange colour; the upper extremity of each stigma spreads out to form a flat lamina with a dentate border. The stigmas simply dried and thrown together loosely, form the ordinary hay saffron of commerce. Persian saffron is, with the aid of some sticky material, pressed together so as to form a thin round flat cake; it is known in Bombay as *Késar-kí-roti* (bread saffron).

Chemical composition.—Flückiger and Hanbury have the following summary:—"The splendid colouring matter of saffron has long been known as *Polychroit;* but in 1851, Quadrat, who instituted some fresh researches on the drug, gave it the name of *Crocin*, which was also adopted in 1858 by Rochleder. The experiments of Weiss in 1867 have shown—

1st—That this substance (Polychroit, Crocin of Rochleder) is a peculiar glucoside, which, by the action of acids, splits into sugar, volatile oil, and a new colouring matter.

2nd—That saffron contains only a minute quantity of ready-formed essential oil and sugar.

3rd—That this free essential oil is probably identical with that which is produced in the decomposition of polychroit.

4th—That polychroit, as hitherto prepared, has always contained a certain proportion of the new colouring matter produced by decomposition."

For the natural glucoside, Weiss retains the name of polychroit, while the new colouring matter which results from its decomposition by an acid he terms crocin. It agrees with the crocetin of Rochleder.

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Polychroit was prepared by Weiss in the following manner:—"Saffron was treated with ether, by which fat, wax, and essential oil were removed, and it was then exhausted with water. From the aqueous solution, gummy matters and some inorganic salts were precipitated by strong alcohol. After the separation of these substances, polychroit was precipitated by addition of ether. Thus obtained, it is an orange-red, viscid, deliquescent substance, which, dried over sulphuric acid, becomes brittle and of a fine ruby colour. It has a sweetish taste, but is devoid of odour, readily soluble in spirit of wine or water, and sparingly in absolute alcohol. By dilute acids, it is decomposed into crocin, sugar, and an aromatic volatile oil having the smell of saffron. Weiss gives the following formula for this decomposition:—

$$\underset{\text{Polychroit.}}{C^{48}H^{60}O^{18}} + H^2O = \underset{\text{Crocin.}}{2(C^{16}H^{18}O^6)} + \underset{\text{Essential oil.}}{C^{10}H^{14}O} + \underset{\text{Sugar.}}{C^6H^{12}O^6}$$

Crocin is a red powder, insoluble in ether, easily soluble in alcohol, and precipitable from this solution on addition of ether. It is only slightly soluble in water, but freely in an alkaline solution, from which an acid precipitates it in purple-red flocks. Strong sulphuric and nitric acids occasion the same colours as with polychroit, the former producing deep-blue, changing to violet and brown, and the latter green, yellow, and finally brown. It is remarkable that hydrocarbons of the benzol class do not dissolve the colouring matter of saffron.

"The oil obtained by decomposing crocin is heavier than water; it boils at about 209°C., and is easily altered, even by water. It is probably identical with the volatile oil obtainable to the extent of one per cent. from the drug itself, and to which its odour is due.

"Saffron contains sugar (glucose?) besides that obtained by the decomposition of polychroit. It leaves after incineration 5 to 6 per cent. of ash." (*Pharmacographia*, p. 604.)

The investigation of the characteristic constituents of saffron, which had previously occupied the attention of several chemists, has been taken up by Herr Kayser (*Berichte*, xvii., 2228). By distilling saffron suspended in water in a current of carbonic

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anhydride, shaking the distillate with ether, and evaporating the ether in a current of carbonic anhydride, the essential oil was obtained as a very mobile, scarcely yellowish coloured liquid, having an extremely intense odour of saffron, readily becoming thick and brown by absorption of oxygen from the atmosphere, and giving upon analysis figures corresponding with the formula $C^{10}H^{16}$. Crocin was obtained by treating an aqueous extract, made without heat from saffron previously exhausted with ether, with purified animal charcoal, which removed all the colouring matter; then filtering, washing and drying the charcoal, boiling it with 90 per cent. alcohol and filtering. Upon removal of the alcohol the crocin was left as a brittle yellow-brown mass, yielding a pure yellow powder, freely soluble in water and dilute alcohol, less soluble in absolute alcohol, and giving up only traces to ether. With concentrated sulphuric acid it gave a deep blue solution, passing to violet, cherry red, and finally to brown; with nitric acid a deep blue, passing almost immediately to brown; with hydrochloric acid it underwent no change of colour. Acetate of lead produced no precipitate in a solution of crocin in the cold, but on warming the solution, decomposition at once took place, and the liquid then reduced Fehling's solution. As previous workers used lead acetate in the separation of crocin, Herr Kayser supposes that their product always contained crocetin. He attributes to pure crocin the formula $C^{44}H^{70}O^{28}$, and to crocetin $C^{34}H^{46}O^{9}$, the decomposition being represented by the following equation:—

$$2\ C^{44}H^{70}O^{28} + 7\ H^{2}O = C^{34}H^{46}O^{9} + 9\ C^{6}H^{12}O^{6}.$$

An ethereal extract of the residual saffron yielded a crystalline bitter substance, freely soluble in water and alcohol, less easily in chloroform and ether, and melting at 75°. This has been named "picrocrocin," and is represented by the formula $C^{38}H^{61}O^{17}$. It presents the interesting character that when warmed in aqueous solution with lead acetate, lime or baryta water or acid, it splits up into sugar and an essential oil, which has a strong odour of saffron and the composition of a terpene.

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The following is the mean of two proximate analyses of saffron by G. Laube and Aldendroff, quoted by König:—

Water	16·07	per cent.
Albuminoids	11·74	„
Fluid oil	·60	„
Fat	3·22	„
Sugar	15·33	„
Non-nitrogenous extractive	44·57	„
Cellulose	4·37	„
Ash	4·37	„

The anhydrous saffron contained nitrogen 2·24 per cent. and oil and fat 4·55 per cent.

Commerce.—Saffron is imported into Bombay from France, and occasionally from China. In 1882-83, the imports were 226 cwts., valued at Rs. 4,25,124; in 1886-87, 268 cwts., valued at Rs. 5,50,383. Most of it is adulterated; a sample examined by Lyon (1875) gave water 9·48, organic matter 56·93, mineral matter (chiefly carb. of lime) 33·59. This adulteration is easily detected by placing a pinch of the saffron in water, when the viscid substance used to make the lime adhere to it dissolves, and the lime falls to the bottom of the glass. Similar adulteration with other heavy powders has been recorded, and vegetable substances, as florets of marigold and safflower, fragments of petals, and fibres of grass and rush, have been found. Pure saffron costs in India Rs. 20 to 22 per lb. Cashmere saffron is exported to the Punjab, where it is much used as a dye, to the value of Rs. 20,000 yearly.

Pardanthus chinensis, *Bot. Mag.* 171, Syn. *Ixia chinensis*, Linn., is the *Balamcanda Schularmani* of Rheede (*Hort. Mal.*, xi., 37), and is a common garden plant in India, having flowers spotted like a leopard's skin. In Cochin-China, China, and the Doons of the Himalayas it grows wild. Loureiro states that the roots are used medicinally in Cochin-China, and that they have aperient and resolvent properties and purify the blood of gross humors, being specially useful in Cynanche. According to Rheede, it is used as an alexipharmic in Malabar, being given to those who have been bitten by the cobra, and to cattle who have fed upon poisonous plants.

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AMARYLLIDEÆ.

CURCULIGO ORCHIOIDE, *Gärtn.*

Fig.—*Wight Ic., t.* 2043; *Roxb. Cor. Pl. i., t.* 13; *Bot. Mag., t.* 1076; *Rheede, Hort. Mal. xii., t.* 59.

Hab.—Hotter regions of India and Ceylon. The root.

Vernacular.—Músali, Músali-kand (*Hind., Mar., Guz.*), Nella-tádi (*Tel.*), Nela-pana-kelangu (*Mal.*), Nila-panai-kizhangu (*Tam.*), Tála-muli (*Beng.*), Nela-táli-gadde (*Can.*), Hín-bin-tal (*Cingh.*).

History, Uses, &c.—Both Hindu and Mahometan medical writers speak of a white and black Músali, which, from their descriptions, appear to have been different varieties of he same plant. In the *Rája Nirghanta* it is stated—मूषली च द्विधा प्रोक्ता श्वेता चापरासंज्ञका श्वेता स्वल्पगुणोपेता अपरा च रसायनी; the plant is described as Hemapushpi, "having golden flowers," and is considered to be alterative, tonic, restorative, and useful in piles, debility and impotence. It enters into the composition of several medicines intended to act as aphrodisiacs and restoratives. At the present time we meet with a white and black Músali in the bazars, but derived from two entirely different plants, viz., the *white* from an Asparagus, and the *black* from a Curculigo. We have been favoured with living specimens of the latter plant collected by Mr. B. B. Nené of Poona at Sitabaldi, and find that when cut and dried it exactly agrees with the bazar article which we have received from most parts of India. From Madras we have received a very small Curculigo root, from *C. brevifolia*, not more than an inch in length, whereas the root of the plant in general use is not less than 6 inches in length, and from ½ to ¾ inch in diameter. Dutt states that Satávari, the root of *Asparagus recemosus*, is sometimes sold by the druggists as white Músali; in Bombay the white Músali of the bazar is the root of *Asparagus adscendens.*

Native medical works give the following instructions for the collection of Músali:—Two-year old plants are to be selected,

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and the roots having been washed and cleared of rootlets, are to be sliced with a wooden knife, threaded upon a string, and dried in the shade; when dry they may be powdered. The dose is 180 grains, to be beaten up with an equal quantity of sugar in a small glass of water or milk until it forms a thick mucilage. Treatment to be continued for forty days, abstinence from mental and physical exercise being enjoined. Músalí is prescribed for asthma, piles, jaundice, diarrhœa, colic, and gonorrhœa; it is considered to be demulcent, diuretic, tonic, and aphrodisiac, and is often combined with aromatics and bitters. Hakim Sharafeddín in his *Mujarabát* has the following humorous anecdote in illustration of its restorative effects:—

من شروع بخوردن این دوا نمودم و پدر من جهت آنکه بازن خود مقاربت نه نمایم مرا بریک جانب و زوجهٔ مرا بجانب دیگرخود میخوابانید چون بیست روز از خوردن این دوا گذاشت از شدت قوت باه و سبق نتوانستم صبرنمود شبی پای خودرا از بالای پدر دراز کرده زن خودرا بران پا سوار نموده بدین طرف آوردم و بااو مقاربت کرده باز برپا سوار نموده بدانجانب فرستادم که دربین پای من لغزش نمود واندک فرود آمد و پای زن من برشکم پدر رسید از خواب بیدار شد گفت ای ظالم چرا تاچهل روز صبر نکردي که این لغزش و ضعف هم نمیماند

The story at once suggests to the reader that in such cases چهل روز صبر is probably as good a tonic as Músalí.

Description.—Músalí occurs as short transverse sections of the root, half an inch or less in diameter, covered externally by a dark-brown bark; the substance of the root is opaque and greyish-brown; portions of the characteristic, wrinkled, vermicular rootlets may usually be found attached to some of the pieces. The taste is mucilaginous and slightly bitter.

Microscopic structure.—The fresh root of *C. orchioides* when cut across presents a firm milk-white, opaque surface, marked with numerous minute punctures. Thin sections show that it consists of a cortical and central portion, both composed mainly of a delicate parenchymatous tissue loaded with small starch granules, here and there a large cell contains a bundle of needle-shaped crystals. The large open passages which can be seen

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with the naked eye are almost entirely confined to the cortical portion; they are lined by the walls of the neighbouring cells. In the central column are numerous bundles of spiral vessels which are mostly situated near its junction with the cortical portion. Many of the starch granules are muller-shaped.

Chemical composition.—A proximate analysis of the powdered roots was made with the following results:—

Ether ext. (fat, &c.)	1·28
Alcoholic ext. (resin, tannin)	4·14
Water ext. (mucilage)	19·92
Starch, &c., by difference	43·48
Crude fibre	14·18
Ash	8·60
Moisture	8·40
	100·00

The resin was soluble in spirit and alkaline solutions, and gave a fine red colour with strong sulphuric acid. The tannin gave a green colour with ferric salts, and when determined separately amounted to 4·15 per cent. of the root. Oxalate of calcium was present.

CRINUM ASIATICUM, var. TOXICARIUM, *Herbert.*

Fig.—*Bot. Mag., tt.* 1073, 2908, 2239; *Wight Ic., t.* 2021; *Rheede, Hort. Mal. xi., t.* 38; *Bentl. and. Trim., t.* 275.

Hab.—Concan. Cultivated throughout India. The bulb and leaves.

Vernacular.—Chindár, Kánwal, Sukhdarshan (*Hind.*), Nágadavana (*Mar.*), Nágdamani (*Guz.*), Nágdaun (*Beng.*), Kesarchettu, Visha-manjili (*Tel.*), Visha-manjil (*Tam.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit writers on Materia Medica, but the juice of the leaves after they have been slightly roasted is a popular remedy in

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Hindustan for earache. The name Sukhdarshan, "pleasant to the sight," is loosely applied to several species of Crinum in most parts of Northern India. In the Concan the leaves smeared with mustard oil or *Mutel** are warmed and bound round inflamed joints. Rheede says:—"Ex planta concisa et tosta bini sunt noduli, qui utrinque maxillæ appositi, spasmum curant cynicum." Ainslie states that the natives of Southern India bruise the leaves and mix them with a little castor oil, so forming an application which they think useful for repelling whitlows and other inflammations that come at the ends of the toes and fingers; also that the juice of the leaves is employed for earache in Upper India. Rumphius, who calls it *Radix toxicaria,* speaks highly of its virtues in curing the disease occasioned by the poisoned arrows of the Macassers in their wars; the root chewed is emetic, provided a little of the juice is swallowed. *Crinum asiaticum* is the *Man-sy-lan* of the Cochin-Chinese, and its virtues are lauded by Loureiro. (*Ainslie, Mat. Ind.,* Vol. II., p. 464.) Sir W. O'Shaughnessy remarks (*Bengal Disp.,* p. 656) that this is the only indigenous and abundant emetic plant, of which he has experience, which acts without producing griping, purging, or other unpleasant symptoms. In the *Pharmacopœia of India,* the root has been made official as an emetic, nauseant, and diaphoretic; directions for making a juice and syrup are given: the former to be given in doses of 2 to 4 fluid drachms every 20 minutes until emesis is produced, the latter in doses of 2 fluid drachms as a nauseant and emetic for children.

Description.—Caulescent or stemless; leaves linear-lanceolate, very smooth; margins entire, striated beneath, 3 to 4 feet long and 5 to 7 inches broad; scapes axillary, shorter than the leaves, a little compressed; flowers numerous, 12 to 50 in an umbel, white, almost inodorous; berries roundish, the size of a pigeon's egg. (*Bomb. Flora,* Pt. I., p. 257.) The root is bulbous, white, with a terminal stoloniferous fusiform portion issuing from the crown of the bulb; it varies greatly in size; odour narcotic and disagreeable.

* The oil obtained from fresh rasped cocoanuts.

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Microscopic structure.—The central portion of the bulb (stoloniferous fusiform portion) consists of a parenchyma made up of polyhedral cells containing a little granular matter and some needle-shaped crystals; it is traversed by numerous bundles of jointed and spiral vessels; surrounding the central portion is a solid cortical layer less vascular than the central column; from both of these spring the subterraneous white bases of the leaves which form the upper part of the bulb.

Crinum zeylanicum, *Linn.*, *Wight Ic.*, 2019—20; *Rheede, Hort. Mal. xi., t.* 39; *Bot. Mag.*, 1171, 2217, 2292, and 2466, is a very variable plant, plentiful in most parts of India. It is the *Tulipa javanica* of Rumphius. Rheede states that the crushed and toasted bulb is applied to piles and abscesses to cause suppuration, and that if given to dogs it causes their teeth to fall out. According to Loureiro, it has the properties of squills. In the Concan a slice of the bulb is used for blistering cattle, and the roasted bulb is used as a rubefacient in rheumatism. The plant is called Sukhdarshan in Bengal and Hindustan, and Gadanikand or Gadámbhikánda in Marathi. It has not been identified with any of the plants mentioned by Sanskrit writers. Its properties are similar to those of *C. asiaticum*.

Description.—Root a spherical, tunicated bulb; leaves numerous, radical, lanceolate, waved, smooth, tapering slowly from within a few inches of the base to rather a broad and obtuse point; margins scabrous with minute cartilaginous teeth, length 1 to 3 feet; scapes from the axils of the decayed leaves, somewhat compressed, 1 to 2 feet long; umbels with about 10 flowers; spathes two, of an ovate conic form, with many soft filaments among the flowers; flowers sessile, large, tube green, border very pale rose, almost white, faintly fragrant; corol tube declinate, cylindric, obscurely 3-sided, about 4 inches long; border campanulate, horizontal, segments lanceolar, with rather soft subulate points; length 3 to 4 inches; filaments six, inserted in the mouth of the tube, declinate; apices sharp and always erect; anthers falcate, incumbent and tremulous, pale yellowish-grey; germ inferior, oblong, 3-celled with several ovula in each,

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attached in two vertical rows to the two lobes of the thick fleshy receptacles; style filiform, declinate, projecting beyond the stamina; stigma small, 3-toothed; pericarpium a soft somewhat fleshy perishable envelope which covers one, two, or three large fleshy bulbiform seeds.

LILIACEÆ.

ALOE PERRYI, *Baker.*

Fig.—*Bot. Mag.*, 6596. Socotrine Aloe (*Eng.*).

Hab.—Socotra.

ALOE ABYSSINICA, *Lam.*

Fig.—*Baker in Linn. Journal, xviii.*, 174. Jaferabad Aloe (*Eng.*).

Hab.—Africa, Coasts of India.

ALOE VERA, *Linn.*

Fig.—*Flora Græca.*, *t.* 341, *cop. in Steph. & Ch.*, *t.* 109, and *Woodville*, vol. v.; *Nees*, *t.* 50. Common or Barbadoes Aloe, (*Eng.*).

Hab.—Africa, Arabia, India. The dried juice.

Vernacular.—Ghikunvár, Kumári (*Hind.*), Ghirta-kunvár, Komári (*Beng.*), Kora-kánda, Koraphád (*Mar.*), Kumára, Kuvára (*Guz.*), Shottu-katrázhai, Kumári (*Tam.*), Kalabanda (*Tel.*), Kátruvazha (*Mal.*), Lola-sara (*Can.*).

The drug Aloes.—Ilva, Yalva (*Hind.*), Moshabbar (*Beng.*), Eilya, Kála-bol (*Mar.*), Kariya-polam, Irakta-polam (*Tam.*), Mushám-baram (*Tel.*), Chenna-náyakam (*Mal.*), Elio (*Guz.*), Musambra (*Can.*).

History, Uses, &c.—The common Aloe (Grihakanya), if not a native of India, must have run wild in the country from a very remote period, as the Sanskrit synonyms do not in any

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way indicate a foreign origin. By the names Ghrita-kumári, Kumári, Mátá, Kanyaka, Taruni, Sávari, the plant is compared to a beautiful girl or to the virgin Durga. Many synonyms are descriptive, such as Dirgha-pattrika "long-leaved," Sthale-ruha "growing in dry ground," Mridu "soft," Bahu-pattra "having numerous leaves," Kantaka-pattra "having prickly leaves," Vipula-srava "juicy," Mandalá "scimitar-like," Ati-picchila "very slimy," &c. The juice is considered to be cathartic, cold, and useful for removing disease of the spleen, swellings, phlegm, carbuncles, and blood and skin diseases. The Hindus appear not to have been acquainted with the drug until it was introduced into India by the Arabs; when this took place it is very difficult to decide, but it must have been at a very remote period if we are to believe Dioscorides, who says "the Aloe grows plentifully in India, whence also the juice is brought to us, also in Arabia and Asia (minor), and in certain maritime districts and islands, as Andros." On the other hand, Sanskrit writers do not mention the drug; possibly the orthodox Hindu physicians of those days may have regarded it as an impure compound prepared by foreigners. *Elwa* or *Ailwa*, the Hindi name for aloes, appears to be cognate to the Greek ἀλοη. Aloes appears to have been first manufactured by Arabs or Abyssinians, through whom the Greeks obtained a knowledge of it. Hippocrates and Theophrastus do not mention it, but Dioscorides and Pliny were evidently well acquainted with the drug and its uses, and also with the plant, which it appears had been introduced into the Cyclades. Abu Hanifeh in the 9th century describes aloes (Sabir) and the plant from which it is obtained as having a yellow flower and very thick leaves which are crushed and thrown into the presses, and trodden with the feet until their juice flows, when it is left until it thickens, and is then put into leathern bags and exposed to the sun until it dries. This method of preparation fully accounts for the inferiority of Arabian aloes. All the Arabian and Persian writers agree in stating that the best aloes is prepared in Socotra, and many relate that Alexander, on the recommendation of Aristotle, took possession of the island on that account and settled a colony of

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Greeks there to cultivate the plant more carefully. Schweinfurth has observed an apparently Semitic type amongst the hill tribes of the island, which he thinks may be traced to a Greek source; characterised by small head, with long nose and thick lips, straight hair, and lean limbs. In some hieroglyphics on the Kadhab plain he has also traced combinations of Greek characters. The Socotrian women are reputed to be sorceresses of the most dangerous kind, who by the aid of a magic cup steal away the liver and lights of those against whom they bear malice; a horrid suggestion to account for the excellence of their aloes. This story seems to support the derivation of the names Socotra and Socotrine suggested by Mr. Mowat in '*Alphita,*' p. 67. He connects them with the Greek συκωτός = Lat. ficatus = It. fegato. This word 'originally seems to have denoted the liver of a goose fattened on figs,' and the word socotrinum or succotrinum applied to aloes would therefore be the equivalent of epaticum. (Cf. *Trans. Rl. Soc. Edinburgh,* xxxi., p. 444.) Burton says: "The aloe, according to Burckhardt, is planted in grave-yards as a lesson of patience: it is also slung, like the dried crocodile, over house-doors to prevent evil spirits entering: 'thus hung without earth and water,' says Lane (*Mod. Egypt,* Chapt. XI.), 'it will live for several years and even blossom. Hence (?) it is called *Sabr,* which signifies patience.' But *Sibr* as well as *Sabr* (a root) means 'long-sufferance.' I hold the practice to be one of the many Inner African superstitions. The wild Gallas to the present day plant aloes on graves, and suppose that when the plant sprouts the deceased has been admitted to the gardens of *Wák,* the Creator." (*Arab. Nights,* i., 138.) Mahometan physicians describe aloes as aperient, deobstruent, depurative, anthelmintic and tonic; as a collyrium they consider that it strengthens the sight and removes styes of the lids; it is often applied for the dispersion of swellings and the promotion of granulations. They direct it to be purified in the following manner:—Take Socotrine Aloes 1 lb., powder and sift, then take wormwood, Jatamási, Chiretta, Cinnamon, Cassia, wood of the Balsam tree, Herba Schœnanthi, Asárum, Mastich, of each 3 dirhems, boil in 2 lbs. of water

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down to one pound and strain. Put the aloes into a mortar, rub it down with part of the above decoction and strain, repeat the process with the remainder of the decoction and any aloes remaining on the strainer, let the strained liquors subside, draw off the supernatant fluid, mix the aloes with 3 dirhems of saffron and preserve for use. In Anthony Colin's translation of Clusius, the following notice of aloes by Garcia d'Orta occurs:—"Les Indiens s'en servent en leurs collyres et aux medicamens purgatifs comme aussi és playes, lesquelles ils veulent remplir de chair pour lequel usage ils ont le plus souvent dedans leur boutiques un medicament composé de myrrhe ét aloes apellé par eux Mocebar (mussabar). J'ai vue un medecin du grand Sultan Badur Roy de Cambaya lequel usoit de l'herbe d'aloes pour medicament familier en ceste façon. Il faisoit cuire avec du sel les fueilles de l'herbe couppées, de telle decoction il en faisoit prendre huict onces lesquelles faisoyent vuider le ventre fort benignement et sans aucune extorsion quatre ou cinq fois. En ceste ville de Goa ils donnent en breuvage a ceux qui ont des ulceres aux reins ou en la vescie de l'aloe bien pulverisé et meslé avec du laict qui a si heureux succes et profit que les malades en sont incontinent gueris. Ils s'en servent aux Indes pour faire meurir les flegmons." In the same work there is a prescription for the use of fresh aloe leaves by Christophe de la Coste. Take of aloe leaves sliced 3 ozs., salt 3 drms., heat to boiling over a gentle fire, strain and add 1 oz. of sugar. Let the liquid cool, and take it cold early in the morning. The patient should be directed to keep moving about to promote the action of the medicine, and four hours after taking it some chicken broth may be given. The leaves and flower stalks of the aloe are pickled by Banians of Guzerat after having been soaked in salt and water, and it is a general practice among Hindus to give a little of the juice of the plant with honey in a golden spoon to new-born children; it is supposed to hasten the expulsion of the meconium. The dose must be administered by the father of the child, or by the nearest male relative in the absence of the father.

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Prof. Bayley Balfour, who visited Socotra on a botanical expedition in 1880, has given the following account of the manner in which aloes is prepared:—"The gum is known as *tâyef* by the natives. The collector scrapes a slight hollow on the surface of the ground in the vicinity of an aloe plant, into which he depresses the centre of a small portion of goat-skin spread over the ground. The leaves of the aloe are cut and laid in a circle on the skin, with the cut ends projecting over the central hollow. Two or three layers are arranged. The juice, which is of a pale amber colour, with a slight mawkish odour and taste, trickles from the leaves upon the goat-skin. After about three hours the leaves are exhausted; the skin containing the juice is then removed from beneath them, and the juice is transferred to a bag made of skin. Only the older leaves are used. The juice thus collected is of a thin watery character, and is known as *tâyef rhiho,* or watery aloes. In this condition it is exported to Muscat and Arabia, and sells for three dollars the skin of 30 lbs. By keeping, however, the aloes changes in character. After a month the juice, by loss of water, becomes denser and more viscid; it is then known as *tâyef gesheeshah,* and is more valuble, a skin of 30 lbs. fetching five dollars; whilst in about fifteen days more—that is, about six weeks after collection—it gets into a tolerably hard solid mass, and is then *tâyef kasahul,* and is worth seven dollars a skin of 30 lbs. In this last condition it is commonly exported. (*Trans. Rl. Soc. of Edinburgh,* xxxi., *Introductory Chapter,* p. xxxviii.).

Description.—Socotrine aloes is imported into Bombay *viâ* Zanzibar and the Red Sea ports. It is packed in skins, the packages varying much in size and shape, and often containing a large proportion of rubbish, such as pieces of hide, stones, &c. In Bombay the skins are opened, and the aloes repacked in boxes for exportation to Europe. The best Socotrine aloes is of a golden-brown colour, hard externally, soft internally: the odour is aromatic and peculiar; when powdered or in thin fragments it is orange-brown, sometimes it is almost fluid.

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Jaferabad Aloes is made at Jaferabad, a town on the coast of Kathiawar, belonging to the Hubshis of Jinjíra, a family of African origin. The drug in mass is black; it has a glassy fracture; thin pieces are yellowish-brown and translucent; the powder is of a dull yellow; the odour powerfully aloetic, with an aroma like Socotrine aloes; when brought in contact with nitric acid it does not turn red. Its reaction is then the same as Socaloin. Jaferabad Aloes is generally in the form of flat circular cakes. From Zanzibar an aloe is imported which very closely resembles Jaferabad; it gives the same reaction with nitric acid.

Yamani or **Moka Aloes**, also called Aden Aloes, is imported from Arabia, and is the kind most in use among the natives of India. It varies much in quality. It is of a black colour in mass, and somewhat porous, but thin fragments are translucent and yellowish-brown; the odour is powerfully aloetic, without the aroma of Socotrine or Jaferabad Aloes; medicinally it appears to be sufficiently active. With nitric acid it gives a deep red colour, like Barbadoes; the solution in sulphuric acid is not affected by nitric acid fumes.

Mysore aloes is made in Mysore from a plant which is probably only a variety of *A. vera*. It is called Musambra in Southern India, and is used in the arts in preparing a false gilding for decorations.

Chemical composition.—All kinds of aloes have an odour of the same character and a bitter disagreeable taste. The odour, which is often not unpleasant, especially in Socotrine Aloes, is due to a volatile oil, which the drug contains only in minute proportion. The oil is a mobile pale yellow liquid, of sp. gr. 0·863, with a boiling point of 266° to 271°C.

"Pure aloes dissolves easily in spirit of wine with the exception of a few flocculi; it is insoluble in chloroform and bisulphide of carbon, as well as in petroleum ether. The specific gravity of fine transparent fragments of aloes, dried at 100°C., and weighed in the last-named fluid at 16°C., has been found to be 1·364, showing that aloes is much more ponderous than most

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of the resins, which seldom have a higher specific gravity than 1·00 to 1·10. In water, aloes dissolves completely only when heated. On cooling the aqueous solution, whether concentrated or dilute, becomes turbid by the separations of resinous drops, which unite into a brown mass, the so-called resin of aloes. The clear solution, after separation of this substance, has a slightly acid reaction; it is coloured dark-brown by alkalies, black by ferric chloride, and is precipitated yellowish-grey by neutral lead acetate. Cold water dissolves about half its weight of aloes, forming an acid liquid which exhibits similar reactions. The solution of aloes in potash or ammonia is precipitated by acids, but not by water. (*Pharmacographia*, p. 686.)

The most interesting constituents of aloes are the substances known as *Aloin*. The Aloin of Jafarabad Aloes has been examined by W. A. Shenstone. About 1½ lb. of the powdered aloes was treated with enough proof-spirit to make a thin paste, and after standing for a few hours was enveloped in folds of stout calico and submitted to powerful pressure, by which means about 28 per cent. of crude Aloin was obtained. This was purified by twice crystallizing from water, then by crystallizing several times from dilute spirit, and finally by crystallizing twice or thrice from rectified spirit. Portions of the crops of crystals thus obtained were burnt with the following results:—

I. ·1104 gram of aloin which had been once crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·2438 gram of CO^2 and ·0561 gram of H^2O.

II. ·1380 gram of aloin which had been twice crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·3042 gram of CO^2 and ·0696 gram of H^2O. Corresponding to

	Carbon.	Hydrogen.	Oxygen.
I.	60·22	5·64	34·14
II.	60·11	5·60	34·29

The aloin therefore was evidently in a pure state. 1·2375 gram of pure air-dried aloin dried over sulphuric acid in a vacuum lost ·1987 gram of water, corresponding to 16·0 per cent.

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When bromine water was added in excess to an aqueous solution of the aloin, a copious yellow precipitate fell. This was collected after having been in contact with excess of bromine water for an hour, washed, dried, and crystallized three times from spirit. The brominated aloin was in beautiful yellow crystals, which were rather soluble in cold alcohol, and were somewhat more stable than the aloin itself. It retained only a trace of water when dried in a vacuum over sulphuric acid, which was given off on heating to 100° C. to 110° C. ·2526 gram of the perfectly dry substance gave ·2539 gram of silver bromide, corresponding to 42·75 per cent. of bromine.

In 1875, Dr. Tilden proposed, as the result of the consideration of a number of analyses of aloins and their derivatives made by himself and others, that the aloins obtained from Barbadoes and Zanzibar aloes might be considered isomeric bodies, with the empirical formula $C^{16}H^{18}O^{7}$, which also agrees closely with his analysis of nataloin. This formula requires 59·62 per cent. of carbon and 5·59 per cent. of hydrogen. Its tribromo-derivative requires 42·93 per cent. of bromine.

It will be seen that of the numbers obtained in Mr. Shenstone's analysis, those for the hydrogen and bromine agree very closely with these, and that the proportion of carbon, though a little high, also agrees fairly well.

The water of crystallization found, 16 per cent., is rather more than the amount which would correspond to three molecules, *i.e.*, 14·3 per cent. The difficulty of getting air-dried aloin of constant composition, however, is so great that the result is not of much value.

The following comparative observations with Jafarabad aloin and Dr. Tilden's zanaloin were made:—

There is no distinguishable difference in the crystalline form of the two aloins.

Neither of them gives any change of colour in the cold when moistened with ordinary strong nitric acid; both of them are reddened by fuming nitric acid. And the Jafarabad aloin, by

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prolonged treatment with nitric acid, yields chrysammic, aloetic, picric, and oxalic acids as zanaloin and barbaloin do.

Jafarabad aloin, when treated with potassium chlorate in a hydrochloric acid solution, yields a chloro-body resembling that given by zanaloin, and when heated with acetic anhydride gives an acetyl compound similar to acetyl-zanaloin.

Both of them, when treated with strong sulphuric acid and potassium bichromate, give a violet coloration closely resembling that given by strychnia, but quickly fading to green.

These results seem to leave no doubt that the aloin of Jafarabad aloes is identical with that from Zanzibar aloes, though the colour of the former is distinctly a lighter shade of yellow than that of the latter.

The main points of difference among the aloins may be tabulated thus:—

1. Nataloin obtained from Natal aloes, yields only picric and oxalic acids by treatment with nitric acid. Is not reddened, even on heating, by that re-agent.

2. Barbaloins yield chrysammic, aloetic, picric, and oxalic acids by treatment with nitric acid. They may be divided into—

(A) *a*-barbaloin, obtained from Barbadoes or Moka aloes. Is reddened in the cold by ordinary strong nitric acid.

(B) *b*-barbaloin, obtained from Socotrine, Zanzibar, and Jafarabad aloes. Is not coloured by cold nitric acid, but gives an orange-red coloration when heated with it, and also gives a coloration in the cold with fuming nitric acid. (*Shenstone in Phar. Journ.*, Dec., 1882.)

Commerce.—Bombay is the centre of the Aloes trade in the East and imports from Arabia (and Socotra through Aden) yearly about 1,500 cwts. of the drug valued at about Rs. 30,000. Of this quantity from 300 to 400 cwts. (chiefly Socotrine) are re-exported to Europe, and 200 to 300 cwts. to Eastern ports, the remainder being consumed in India.

Madras and Sind occasionally export small quantities of Indian aloes to Eastern ports.

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The Indian varieties of the drug are manufactured in Kattiawar (Jafarabad) and in Mysore, and are consumed locally. It is impossible to form a correct estimate of the quantity produced, but we do not think it can be very great, as the Arabian aloes is the drug met with in most parts of India.

URGINEA INDICA, *Kunth.*

Fig.—*Wight Ic.*, *t.* 2063. Indian Squill (*Eng.*).

Hab.—India. The bulb.

Vernacular.—Kándá, Jangli-piyaj (*Hind.*, *Beng.*), Kol-kándá, Kochinda (*Mar.*), Nari-vengayam (*Tam.*), Nakka-vulli-gadda (*Tel.*), Kattulli (*Mal.*), Adavi-irulli (*Can.*), Jangli-kánda (*Guz.*).

History, Uses, &c.—This plant is not mentioned in the Nighantas, but the bulb is used in the preparation of Chándi-bhasma or "ashes of silver" which is used medicinally by the Hindus. Indian Mahometan writers consider the Indian squill to be identical in medicinal properties with the squill of Europe, which was used by the Greeks, who prescribed it combined with vinegar and honey much as we do at the present time (*Diosc.* ii., 162); they presoribe it in paralytic affections, also as an expectorant, digestive, diuretic, and deobstruent in many diseases, more especially in asthma, dropsy, rheumatism, calculous affections, leprosy, and skin diseases; it is also considered to be emmenagogue. In the West *Urginea Scilla* has been used in medicine from the time of Hippocrates; in Egypt it was sacred to the god Typhon and at Pelusium there was a temple dedicated to it; it was thought to have the power of driving away evil spirits, and to be symbolic of perpetual generation. The Arabs, who followed the Greeks in their estimation of its medicinal value, call it Basal-el-unsal "sea onion," or Basal-el-fár "rat's onion," and the Persians, Piyáz-i-dashti "wild onion." European physicians in India have expressed various opinions as to the medicinal activity of *Urginea indica* (confer. *Phar. of India*, p. 241), but there would appear to be no doubt that the young freshly-dried bulbs are sufficiently active, as they have been

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used for many years at certain of the Government Medical Store Depôts for making the various preparations of the drug.

In India the squill is always kept by native druggists in the entire state, this form being preferred by the hakims to the sliced and dried bulb. They follow the Greeks and Romans in their method of baking squills (cf. *Diosc. loc. cit.* and *Scrib. Larg. Comp.* 76).

Description.—*Urginea indica* is very abundant in sandy ground near the sea; the dirty white spike of flowers appears long before the leaves. The bulb is tunicated, consisting of fleshy coats, which enclose each other completely, generally about the size of a common onion; colour white; taste bitter and acrid.

Microscopic structure.—Each scale or modified leaf is made up of polyhedral cells covered on both sides by an epidermis provided with stomata; like a leaf, it has vascular bundles. The cells of the parenchyma are loaded with mucilage, and contain an enormous quantity of needle-shaped crystals and a few large square or oblong prisms. The presence of the former accounts for the itching of the hands experienced by those employed to slice the bulb.

Chemical composition.—The sample dried at 100° C. was examined by Dragendorff's method, with the following results:—

Petroleum ether extract	·036	per cent.
Ether extract......................	·028	„
Absolute alcohol extract.........	·152	„
Aqueous extract	77·30	„
Ash..................................	5·69	„

The petroleum ether extract was a greasy white residue and non-crystalline. The ether extract contained no alkaloidal principle; under the microscope a few imperfect four-side plates were visible.

The alcoholic extract from 9 grams of the anhydrous squills injected into a cat's stomach caused vomiting in 20 minutes, and the passage of a solid stool about an hour after

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the injection; no blood in vomit or stool; the cat was not otherwise affected in any way. The aqueous extract consisted chiefly of gum.

The fresh squill in slices distilled with water afforded a distillate possessing an aromatic odour, but in which no appreciable amount of oil was visible. The distillate was agitated with ether; on spontaneous evaporation of the ether, a minute trace of a white greasy residue was left, possessing an aromatic odour—applied to the skin no irritation was induced. We are indebted to Assistant Surgeon C. L. Bose for the above analysis, which was conducted in the Chemical Examiner's Laboratory, Calcutta.

Substitutes for Squills.—The bulbs of different species of Ledebouria (Scilla, *Linn.*) are sold in the Indian bazars under vernacular names which are equivalent to "small squill." *L. hyacinthoides* is said by Ainslie to be used by farriers in Southern India for the relief of strangury and in fevers occurring in horses. (*Mat. Ind.*, i., p. 402.) From Dr. Hové we learn that the bulbs were used in the Colaba Hospital, Bombay, by Mr. Guise, the Surgeon of the island in 1787, instead of squills. For many years they were issued from the Bombay Medical Stores in lieu of squills (*Indian Journ. of Med. Phys. Sci.*, Jan. 18th, 1838, p. 9), but of late years *Urginea indica* has been in use; both appear to be equally satisfactory substitutes for squills.

L. hyacinthoides has a scaly bulb, about the size and shape of a small pear, composed of very smooth and fleshy scales, which are so imbricated that they might be mistaken for entire coats if not carefully examined; the exterior scales are dry and whitey-brown, the interior fleshy and cream-coloured; the odour is nauseous; the taste bitter and acrid.

Bulbs, the size of a large nut, purchased by one of us in the Bombay shops, which we have cultivated, proved to be those of *Ledebouria maculata*, Dalz. The leaves were obovate, glabrous, wedge-shaped, attenuated into the petiole, purple spotted, and never bearing bulbs; scapes bearing a many-flowered raceme

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of small asphodel-like flowers having a delicate purplish-blue tinge, and a bloom like that of the Auricula. This plant is very common in the Concan, and comes into blossom in June, immediately after the first fall of rain.

ASPHODELUS FISTULOSUS, *Linn.*

Fig.—*Wight Ic., t.* 2062; *Sibth. Fl. Gr., t.* 335.

Hab.—Northern India, Afghanistan. The seeds.

Vernacular.—Piazi, Bokhat, Binghar-bij (*Punjab, Sind*).

History, Uses, &c.—The plant has a reputation in Sind and the Punjab as a diuretic, and the seeds are sold in the shops; it is very abundant in cultivated ground about Jhelum and in Southern Afghanistan. (Murray.) Sibthorp describes it as common near Athens. In Northern India and Afghanistan it is eaten as a vegetable. Hesiod, who wrote about 800 B. C., when he enjoins temperance and simplicity of living in his "Works and Days," says (ver. 30):—

νήπιοι. ὀυδέ ἴσασιν, ὅσῳ πλέον ἥμισυ παντὸς
οὐδ' ὅσον ἐν μαλάχῃ τε καὶ ἀσφοδέλῳμέγ ὄνειάρ.

How much is the half better than the whole! How great a blessing is there in Mallows and Asphodel! Theophrastus, in his *History of Plants* (vii., 11), tells us that Asphodel roots were eaten by the Greeks, and an Asphodel is described by Dioscorides* as a medicinal plant having diuretic and deobstruent properties when given internally, and being useful as an external application to ulcers and inflamed parts, &c. The Romans called the same plant '*Hastula regia,*' or king's spear, and used it as a remedy for *morbus regius* or ἴκτερος (cf. *Hipp. de Morbis,* ii., 35). Arabic and Persian writers on Materia Medica describe an Asphodel with white flowers under the name of Khunsa (خنثى), the same, or a very similar plant, is called

* Diosc., ii., 159. The Anthericon of Theophrastus was probably the Yellow Asphodel. In Western and Southern India *Anthericum tuberosum,* Roxb., is in common use as a vegetable, boiling appears to remove the acrid properties of these plants.

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Ashrásh, or Saresh in Persian; Ibn Sina says اصل الخنثى ورا لاشراش. To this plant they attribute the same properties as Dioscorides does to Asphodel (confer. *Tuhfat-el-muminín*, article خنثي). The root of *Asphodelus bulbosus* under the name of Teinisse is used in the East to prepare mucilage and adulterate salep.

Description.—Annual, stem naked, ramous; leaves erect, linear, cylindric, fistulous, tapering to a point; scape erect, branched; flowers small, white with a brownish line running along the centre; filaments ciliate, contracted; corol 6-partite; stigma capitate; ovary 3-celled.

GLORIOSA SUPERBA, *Linn.*

Fig.—*Bot. Reg.*, *t.* 77; *Wight Ic.*, *t.* 2047; *Rheede, Hort. Mal. vii.*, *t.* 57. Superb Lily (*Eng.*).

Hab.—Throughout India. The tubers.

Vernacular.—Kalihári, Lánguli (*Hind.*), Bisha-lánguli (*Beng.*), Nága-karia, Indai, Kalávi (*Mar.*), Kalaipai-kizhangu (*Tam.*), Kalappa-gadda, Adavi-nábhi (*Tel.*), Rádágári (*Can.*), Khadya-nága, Nágli, Kalalávi (*Guz.*).

History, Uses, &c.—This very ornamental creeper is common on hedges during the rainy season, and its flowers are used by the Hindus in the worship of Siva and the Lingam. It is one of the seven minor poisons of Sanskrit writers, and is described in the *Rája Nirghanta* under the name of Kalikári. The synonyms are numerous; amongst those which are descriptive we may mention Chihna-mukhi "having a spotted mouth," Sukra-pushpika "having splendid flowers," Agni-sikha "having a crest of fire," and Langalika "plough-like," in allusion to the shape of the root.

Other synonyms, such as Garbha-ghátini, Garbha-pátani, Garbha-nud, allude to the use of a paste of the root as an application to the lower part of the abdomen for the purpose of promoting labour pains. In retained placenta a paste of the root is applied to the palms of the hands and soles of the feet,

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whilst powdered Nigella seeds and long pepper are given internally with wine. According to the Nighantas, the root is purgative, hot, light, and pungent; it increases the secretion of bile, and is useful in leprosy, piles, colic, boils, and to expel intestinal worms. The starch obtained from the root by washing is given internally in gonorrhœa.

Moodeen Sheriff, who has experimented with the root, states that it is not so poisonous as is generally supposed; he has taken it in small quantities, gradually increasing the dose to 15 grains. There were no bad effects, but on the contrary he found his appetite improved and felt more active and stronger. He has also used it in his practice for many years, and considers it to be a tonic and stomachic in doses of from 5 to 12 grains given three times a day. In the Concan it is given to cattle to expel worms, and in Madras it is believed to be a specific against the bites of poisonous snakes, and the stings of scorpions, and is also used as an external application in parasitical skin affections. Surgeon-Major Thomson states that before being used for these purposes it is cut up into thin slices and soaked in butter-milk and salt for four or five days, and then dried, by which process its poisonous properties are supposed to be removed. He also says that the natives select those roots which are dichotomous and which they suppose to be those of the male plant, whilst single roots, which they suppose to be those of the female plant, are rejected. (*Dict. Econ. Prod. India*, iii., p. 507.)

Description.—Root tuberous, cylindrical or flattened, often 7 to 8 inches in length, and about one inch in diameter; when fully grown it consists of two tubers which unite at a right angle, one being much shorter than the other; at the point of union may be seen, on the upper surface, a circular scar marking the attachment of the stem, and on the under surface immediately beneath it another, to which a tuft of their rootlets is often attached. The tubers are covered with a brown epidermis, except at their points, which are tapering and nearly white; internally they are juicy, white, and farinaceous, and have a

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faint acrid odour. The taste is mucilaginous, feebly bitter, and has an acid taste. The starch granules are mostly ovoid, the vascular bundles few, consisting of spiral and jointed vessels. The root is figured by Lyon. (*Med. Juris. for India*, p. 210.)

Chemical composition.—The root has been examined by Warden, who obtained from it two resins, a tannin, and a bitter principle which he has provisionally named *Superbine.* He considers that the bitter principle is closely allied to, if not identical with that of squills. It was found to be very poisonous, 0·047 gram injected into the stomach being sufficient to kill a full-grown cat. (*Ind. Med. Gaz.*, Oct. 1880.)

Toxicology.—Ainslie and others speak of the root as violently poisonous, and it finds a place in the list of Indian poisons published by Chevers. (*Indian Ann. of Med. Sci.*, ii., p. 147.)

Dr. Buttacharjee (*Ind. Med. Gaz.*, 1872, p. 153) reports the following case:—A female, æt. 18, swallowed a quantity of the powdered root. Symptoms of poisoning appeared in half an hour, and were: retching, violent vomiting, spasms and contortions of the body, with fearful racking pain; from time to time there were short intervals of relief, followed by a recurrence of the same symptoms. Death took place in four hours. The *post-mortem* appearances were congestion of the brain and its membranes, with extravasations of blood. The lungs, liver, and kidneys were all deeply congested. The gastric mucous membrane showed signs of inflammation. The peritoneal covering of the fundus of the uterus (unimpregnated) was also found inflamed.

ASPARAGUS RACEMOSUS, *Willd.*

Fig.—*Wight, Ic.*, *t.* 1056.

Hab.—Throughout India.

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ASPARAGUS SARMENTOSUS, *Willd.*

Fig.—*Rheede, Hort. Mal. x., t.* 10.

Hab.—Upper India, Concan, and Deccan. The roots.

Vernacular.—Satáwar, Satávari (*Hind., Guz., Mar.*), Satamuli (*Beng.*), Shatávali (*Mal.*), Kilávari (*Tam.*), Shatávari (*Tel.*), Shípari (*Can.*).

History, Uses, &c.—These two plants appear to be the Satávari and Maha-satávari of the Nighantás: among the synonyms of the first, we find Dvipika, Dvipa-satru, Vara-ghantika, Náráyani, and Sata-padi; the synonyms of the second are very similar, amongst them we note Bahu-puttrika, Dagdha, and Bhasma-rohâ. Both plants are considered to be heavy and cold, sweet, demulcent, galactogogue, tonic, and strengthening, and to remove bilious and rheumatic humors, blood diseases, and swellings; they are used both internally and in the preparation of several medicated oils. The tubers are candied and eaten as a sweetmeat. The fresh juice of the root is given with honey as a demulcent in bilious dyspepsia or diarrhœa (*Sárangadhara*). As an aphrodisiac, Chakradatta directs four *sérs* of the juice of the roots and four *sérs* of *ghi* to be boiled in forty *sérs* of milk, and to be flavoured with sugar or honey, and long pepper.

The chief use of the drug, however, is in the preparation of medicated oils for external application in nervous and rheumatic affections and urinary disorders. The *Náráyana taila*, a popular remedy of this kind, contains the barks of *Ægle Marmelos, Premna integrifolia, Oroxylum indicum, Erythrina indica, Stereospermum suaveolens*, and *Pæderia fœtida;* the roots of *Withania somnifera* and *Boerhaavia repens*, the fruit of *Tribulus terrestris*, and the leaves of *Solanum xanthocarpum, Solanum indicum, Sida cordifolia* and *Sida rhombifolia*, of each twenty tolas. The whole collection is boiled in 64 *sérs* of water down to one-fourth and strained. To the strained decoction is added four *sérs* each of the juice of Satávari and

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prepared sesamum oil, sixteen *sérs* of cows' or goats'milk, and a paste prepared with four tolas of each of the following drugs—Fennel seeds, wood of *Cedrus Deodara*, root of *Nardostachys Jatamansi*, liquid storax, Acorus root, sandalwood, herb of *Limnanthemum cristatum*, costus, cardamoms, leaves of *Desmodium gangeticum*, of *Uraria lagopoides*, of *Phaseolus trilobus*, and of *Teramnus labialis*, roots of *Withania somnifera*, *Vanda Roxburghii*, and *Boerhaavia repens*, rock salt. The whole is then reboiled and perfumed. (*Chakradatta.*)

Description.—Both plants are scandent woody shrubs, the roots of which consist of numerous fusiform, smooth, perennial tubers, 6 to 8 inches long and ½ inch in diameter. They have a light brown, silicious external covering which is removed before they are used. The substance of the fresh tubers is mucilaginous, white, and somewhat translucent, and has a mawkish, insipid flavour.

Chemical composition.—The powdered roots were separated into—

Water extract	52·43
Crude fibre	33·65
Moisture	9·46
Ash	4·46
	100·00

The amount of saccharine matter, estimated as glucose, in the water extract was 7·14 per cent. Some of this extract was boiled and filtered and evaporated down to a soft consistence and allowed to remain for three months under a bell jar. At the end of that time no crystalline substances had formed, indicating the probable absence of crystalline sugars, mannite, and asparagin.

Asparagus adscendens, *Roxb.*, is an herbaceous, erect, thorny plant growing in Rohilkhand, Guzerat, and other parts

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of Central India. Though not mentioned in the Nighantás, the tuberous root, decorticated and dried, is in general use in India under the names of Suffed-músli, Dholi-musali, or Ujli-músali. The commercial article consists of shrivelled decorticated tubers, from 2 to 2½ inches long, the largest being about ¼ inch in diameter; they are of an ivory white colour, often twisted, hard and brittle; adhering to some of the pieces may be seen portions of a yellowish epidermis; when soaked in water they swell up and become spindle-shaped, the thickest part being about the size of a lead pencil. Under the microscope these tubers present a delicate cellular structure, the cells of which contain nothing but a little fine granular matter and mucilage; this surrounds a central vascular column, the middle part of which is entirely occupied by jointed vessels, the outer portions consisting of scalariform; the portions of adherent epidermis already mentioned are silicious. Suffed-músli has an agreeable mucilaginous taste; we have used it largely as an article of diet; it is far nicer than Salep, and is generally relished by Europeans. To prepare it, take 200 grs. of the powder, 200 grs. of sugar, pour upon them slowly a large teacupful of boiling milk, stirring constantly all the time. The best white picked roots are worth Rs. 25 per maund of 37½ lbs.

Chemical composition.—The powdered roots were examined as those of the previous article, and were found to contain—

Water extract	77·55
Cellulose	12·85
Moisture	6·00
Ash	3·60
	100·00

The water extract was a thick mucilaginous liquid which threw out white flocks of albuminous matter when boiled, and was not affected by Fehling's solution. The portion of the root insoluble in water consisted of almost pure cellulose.

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ASPARAGUS OFFICINALIS, *Linn.*

Fig.—*Eng. Bot.*, 339; *Blackw.*, *t.* 332; Sperage, Asparagus (*Eng.*), Asperge (*Fr.*).

Hab.—Europe, Southern Russia, Turkey. Cultivated in Persia and Northern India. The plant, root, and ripe fruit.

Vernacular.—The fruit, Haliyun (*Ind. Basars*).

History, Uses, &c.—Asparagus was well known to the Greeks and Romans both wild and in a cultivated state. Hippocrates mentions it in his treatise on diet, and in his treatise on the Diseases of Women he says that the berries taken in wine promote conception. Dioscorides and Pliny describe its medicinal properties, and Cato (*De re Rust.* c. 161) gives full directions concerning its cultivation. The ancients considered it to be a wholesome vegetable, dispelling flatulency and acting as a mild aperient, diuretic and aphrodisiac. They administered the root in wine for calculous affections and pains in the uterus, and also considered it beneficial in elephantiasis. Ibn Sina calls it هليون *haliún* and quotes Galen's opinion of its medicinal value.

The Western Arabs call it *Isferáj*; in Persia it is known as *Márchubeh* and *Márgiyeh* "snake wort," from its being considered to be an antidote for snake poison. Wild asparagus, the *A. tenuifolius* of Linnæus, was known to the Romans as Corruda, a name still current in the south of France, where the plant is valued for its medicinal properties up to the present time. Broussais considered asparagus to be a sedative in palpitation of the heart, and it is still used in France as a diuretic in cardiac dropsy and chronic gout. The young shoots when eaten as a vegetable are well known to communicate a peculiar and offensive odour to the urine, a syrup for medicinal use is prepared with their juice, 100 parts after clarification being added to 190 parts of sugar.

Some physicians consider asparagus to be useless as a diuretic and even injurious to the bladder, but as far as our experience goes it has no ill-effects when taken daily for a considerable time. Indian Mahometan writers on medicine merely retail

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what the ancients have said about this plant; they usually prescribe the dried berries which are to be found in the bazars of all large towns.

Description.—The root consists of a short horizontal rhizome about $\frac{3}{4}$ of an inch thick, the upper side is scaly and marked by stem-scars, below it gives off numerous long, whitish, nearly simple roots, which on drying become much wrinkled. It has hardly any odour and a mawkish sweet taste. The berries are scarlet, about the size of a pea, 3-celled, one or two of the cells often abortive, seeds 1-2 in each cell, globose, with a horny albumen, and a transverse embryo, far out of the centre.

Chemical composition.—Examined by Dulong, the root was found to contain yellow resin, sugar, gum, albumin, chlorides, phosphates, malates, and acetates. Vanquelin and Robiquet (1805) discovered *asparagin* in the shoots, a substance which has since been found in many other plants. Reinsch (1870) found in the berries much grape sugar and *spargancin*, an orange-red sublimable colouring matter soluble in ether and crystallizing in scales. The seeds contain a fixed oil, an aromatic resin, crystallizable sugar, and a crystalline bitter principle, *spargin*. Asparagin, $C^4H^8N^2O^3H^2O$, forms colourless, inodorous, and nearly tasteless crystals, which are insoluble in strong alcohol and ether. It unites with both acids and alkalies, and when boiled with them is converted into *aspartic acid*, $C^4H^7NO^4$, and ammonia. Nitrous acid converts it into malic acid, $C^4H^6O^4$, water and nitrogen. For further information concerning Asparagin, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., I., 325.

The mean of four analyses quoted by König gives the following as the proximate composition :—

Water	93·75	per cent.
Albuminoids	1·79	„
Fat	·25	„
Sugar	·37	„
Nitrogen free extractive	2·26	„
Cellulose	1·04	„
Ash	·54	„

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The anhydrous plant contained 4·61 per cent. nitrogen, and 42·08 per cent. carbohydrates.

ALLIUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim.*, 280; *Woodville, t.* 256; *Reich. Ic. Fl. Germ. x., t.* 488. Garlic (*Eng.*), Ail (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The bulbs.

Vernacular.—Lasan, Lahsan (*Hind.*), Rasun, Lashun (*Beng.*), Vallai-pûndu (*Tam.*), Vellulli (*Tel.*), Behuli (*Can.*), Lasuna (*Mar., Guz.*).

History, Uses, &c.—Garlic is used as a condiment and medicine by the Hindus. In the *Raja Nirghanta* it is described under the name of Rasona, and bears many synonyms indicative of its properties, such as Ugra-gandha "strong smelling," Mahanshadha "panacea," Bhuta-ghna "destroying demons," Lasuna, &c. The Hindus consider it to be tonic, hot, digestive, aperient, cholagogue, and alterative; useful in cough and phlegmatic affections, fever, swellings, gonorrhœa, piles, leprosy, colic, rheumatism, and worms. During its use the diet should consist of wine, meat, and acids. A decoction of garlic in milk is given in small doses in hysteria, flatulence, sciatica, and heart disease. A compound garlic powder called *Svalparasona pinda*, which contains garlic, asafœtida, cumin, rock salt, sonchal salt, ginger, long pepper, and black pepper in equal proportions, is given in doses of about twenty grains every morning with a decoction of the root of the castor oil plant, in facial paralysis, hemiplegia, sciatica, paraplegia, and convulsive affections. Garlic juice is applied externally as a counter-irritant. As a condiment, the bulbs are largely used in the East. Garlic is the σκόροδον of the Greeks and Allium of the Romans, who appear to have used three kinds, *A. sativum*, Linn., *A. oleraceum*, Linn., and *A. ursinum*, Linn. It would be tedious to recapitulate all the medicinal properties ascribed to these plants by the ancients, as they hardly differ from those accorded to

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garlic by the Hindu physicians. A summary of them may be found in Pliny (xx., 23). Garlic is the ثوم (thúm) of the Arabians and سیر (sír) of the Persians; their medical writers follow the ancients in mentioning three kinds, *viz.*, Bustání "garden," Bari "wild," and Kiráthi "leek-like," and in the account they give of its medicinal properties. The leek-like garlic is probably meant for the bulbed leek (*Porrum capitatum*) of Hippocrates (*De Morb. Mul.*, ii., 89) which was considered to have the property of opening the uterus when contracted, and De Gubernatis states that in Sicily garlic is still placed upon the beds of parturient women. He also notices the wide-spread belief in the protective power of garlic against evil influences among the Hindus, Scandinavians, Greeks, and Germans, as shown by passages in Sanskrit works, in the Songs of Sigurdrifa and Helgi, the Volsungasaga and Hippocrates. In Bologna, at the present day, it is purchased by every one on the feast of Saint John as a guarantee against poverty during the year, whence the proverb:

Chi 'n compra i ai al de d'San Zvan,
É povret tot gl'an. (*Myth. des Plant.*, ii., 7.)

Garlic is still used medicinally to some extent on the Continent of Europe and in America, but in England it is hardly ever prescribed. A syrup of garlic was formerly official in the Dublin Pharmacopœia, and was given in doses of two drachms in moist asthma. As a condiment, it enters into the composition of most sauces. After intense fatigue a clove of garlic slowly chewed, and swallowed, acts as a very powerful restorative.

Description.—Garlic is a sub-globular compound bulb, surrounded by a few dry membranaceous scales, which cover the remnant of the upright stem and the 5 to 8 small bulbs or cloves arranged in a circle around its base. These bulblets are oblong in outline, compressed from both sides, wedge-shaped toward the stem, and rounded upon the back. They consist of a few thick fleshy scales and a short fleshy axis. Garlic has a peculiar pungent and disagreeable odour, and an acrid, burning taste. It is used in the fresh state only.

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Chemical composition.—Besides cellular tissue, garlic contains between 50 and 60 per cent. of water, 35 per cent. of mucilage, some albumen, sugar, starch, and about ¼ per cent. of volatile oil, to which its odour and taste are due. W. Dahlen gives the following as the percentage proximate composition:—

Water	64·66
Albuminoids	6·76
Fat	·06
Sugar	trace.
Nitrogen free extractive	26·31
Cellulose	·77
Ash	1·44

Anhydrous garlic contained nitrogen 3·06 per cent. and carbohydrates 74·45 per cent. (*Landw. Jahrbücher*, 1874.)

In its crude state *oil of garlic* is of a dark brown-yellow colour, heavier than water, of a very repulsive taste, and consists of oxide and sulphides of allyl. The rectified oil consists mainly of the sulphide, $(C^3H^5)^2S$, is colourless, lighter than water, and may be obtained artificially by treating an alcoholic solution of potassium sulphide with allyl iodide. It dissolves easily in alcohol and ether, and sparingly in water; with nitrate of silver, mercuric chloride, and other metallic salts it forms crystalline compounds. Garlic, macerated in water or vinegar, yields its virtues to these liquids. (*Stillé and Maisch.*)

Allylic sulphide can also be obtained from the herb and seeds of *Thlaspi arvense*, together with sulphocyanide of allyl, and oil of mustard. The leaves of *Sisymbrium Alliaria* yield oil of garlic, and the seeds oil of mustard. A mixture of these two oils is also yielded by *Capsella Bursa-pastoris, Raphanus Raphanistrum*, and *Nasturtium*. In some cases the oils do not exist ready formed; for example, the seeds of *Thlaspi arvense* emit no odour when bruised, and they must be macerated in water some time before distillation. (*Watts.*)

Commerce.—Garlic is cultivated all over India, and is on sale in every grocer's shop. No statistics are available as to the

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quantity produced in India, which must be very large. Value, about Rs. 8 per cwt.

ALLIUM MACLEANI, *Baker.*

Fig.—*Bot. Mag.*, 6707; *Hanbury, Sci. Papers*, p. 156—57.

Royal Salep (*Eng.*).

Hab.—Persia, abundant in the Badghis. The bulbs scalded and dried.

Vernacular.—Bádshah or Pádshah Sálab (*Ind. Bazars*).

History, Uses, &c.—This bulb appears to be the second kind of Sálab mentioned by Mir Muhamad Husain in the *Makhzan*, which he describes as black and shining. It is brought to India by Afghans in small parcels along with the dried fruit and other articles for which they find a sale in the Indian Bazars. A solitary specimen of the dried bulb was sent to Hanbury by Dr. J. E. Stocks, but did not at the time attract attention. In 1858, however, a parcel containing about 100 lbs. having been offered for sale in the London market, Hanbury recognised the drug as identical with the bulb he had received from Dr. Stocks as *Badshah Saleb*, and described it in the *N. Repert. f. Pharm.*, vii., 271. In India the drug is regarded as a kind of salep, and is used as such, but, as Hanbury remarks, its bitterish somewhat acrid taste quite unfits it as a substitute for salep in Europe. The botanical source of the drug was discovered by Dr. Aitchison in 1888.

Description.—Royal salep consists of dried bulbs whose dimensions from base to apex vary from 1½ to 2 inches. The largest specimens weigh 730 grains: the average weight, taking twenty bulbs, was found to be 337 grains. Allowing for considerable irregularity occasioned by drying, the form of the dried bulbs may be described as usually nearly spherical, sometimes ovoid or nearly oblong, always pointed at the upper extremity, and having at the lower either a depressed cicatrix, or frequently a large, white, elevated, scar-like mark. Their

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surface is striated longitudinally, besides which there is mostly one broad and deep furrow running in the same direction. They are usually translucent, and from yellowish-brown to deep purple in colour. In substance the bulbs are dense and horny. After several hours' maceration in water, they become soft, opaque, and of a slaty or purplish hue, and increase greatly in volume, regaining their natural size and form. If, in this state, a bulb be cut longitudinally into two equal portions, it will be seen to consist of a single fleshy envelope or scale of excessive thickness whose edges overlap each other; this scale surrounding an elongated, flattened bud. (*Hanbury.*)

Chemical composition.—The powdered bulbs, unless kept in well-stoppered bottles, readily absorb moisture from the air. A decoction is not coloured with iodine, but is precipitated with solutions of ferric chloride and plumbic acetate. No reaction for glucose is produced by boiling with Fehling's solution. The ash contained manganese. The powdered bulbs afforded moisture 8·11 per cent., mucilage (water extract) 80·80, cellulose 7·14, and mineral matter 3·95 per cent.

Allium xiphopetalum, *Aitch. et. Baker, Trans. Linn. Soc. 2nd Ser. Botany,* Vol. III., Pt. 1, pl. xlviii., yields the Thúm-el-bari or "wild garlic" of the Arabs. It has a bulb resembling Badshah Salep in shape and appearance, but much smaller, a powerful garlic odour, and is much used for pickling by the natives. Large quantities are imported. It appears to have been sometimes confounded with Badshah Salep.

In Persia it is known as Sír-i-piazak or "onion garlic." Aitchison found it growing abundantly in the Badghis. In Bombay it is best known as Muscat garlic, from its being shipped from that port.

Allium ascalonicum, the Shallot, is called by the natives *Ek-kánda-lasun* or *Ekla-kali-lasan,* "one-clove garlic," and is used by them to cure earache, a small piece being placed in the meatus. It is also fried in butter and preserved in honey as an aphrodisiac.

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Polianthes tuberosa, *Linn., Bot. Mag., t.* 1817; *Bot. Reg., t.* 63—*Vern.* Gulshabbo, Gulchérí (*Hind., Bomb.*), Raja nígandha (*Beng.*), is the Tuberose of the English, the *Fulla-pipa* of the Portuguese, and the *Amica nocturna* of Rumphius (*Amb.,* v., t. 98); it is a common garden flower, considered by the natives to be hot and dry, diuretic, and emetic. The bulbs are used as a remedy for gonorrhœa. In the Concan they are rubbed with turmeric and butter and applied to remove वत्या (Watiya), small red pimples which often trouble new-born children. They are also rubbed into a paste with the juice of Durva grass (*Cynodon dactylon*) and applied to buboes. The flower is much valued on account of its perfume, for which it is cultivated in France; it sometimes emits phosphorescent flashes of light in the night.

SANSEVIERA ZEYLANICA, *Willd.*

Fig.—*Roxb. Cor. Pl. ii., t.* 184; *Bot. Reg., t.* 160; *Rheede, Hort. Mal. xi., t.* 42. Bowstring Hemp (*Eng.*).

Hab.—Indian Peninsula. The leaves and root.

Vernacular.—Murahri, Marúl (*Hind.*), Murba, Goráchakra (*Beng.*), Márúl-kálang (*Tam.*), Ishâma-koda-nâr (*Tel.*), Ghan-asphan, Morvel (*Mar.*), Katu-kapel (*Mal.*), Heggurutiké (*Can.*), Murvel (*Guz.*).

History, Uses, &c.—This plant is the Múrvá of Sanskrit writers; it is mentioned by Manu (ii., 42, 44) as the source of the fibre from which the bowstrings and girdle (*maurvi*) of the Kshatriya or warrior caste of Hindus was made. In the *Uttaracharitra* the young prince Lava is represented as wearing a garland of *Múrvá* as symbolical of his position of warrior and penitent. In the Nighantás it bears numerous synonyms, such as Dévi "goddess," Moratá, Madhurasa, Madhusrava "having a sweet juice," Snighda-parni "having glossy leaves," Prithak-parni "diverse-leafed," Pílu-parni, &c., and is described as purgative, heavy, sweet, pungent, tonic, and cardiacal; a remedy for bile, heat of blood, gonorrhœa, *tridosha* (a corruption

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of the three humors), thirst, heart disease, itch, leprosy, fever, rheumatism, and glandular enlargements. Rheede gives the following account of its medicinel uses in Malabar:—"Folia trita et in formam boli redacta, adversus opthalmiam et oculorum suffusionem assumuntur: cum radice addito Allio ac Auripigmento in oleo *Sergelim* decocta, gonorrhæam sanant, si nempe caput cum oleo illo illinatur. Bulbus cum Sandalo citrino et butyro bubulino tritus linimentum exhibet, in nervorum contractionibus et ardoribus adhibendum. Tota denique planta oleo butyroque incocta omnium acculorum vitia emendat."

Ainslie (*Mat. Ind.*, ii., 192) remarks:—"This fleshy creeping root is, in a slight degree, warm to the taste, and of a not unpleasant odour; and is prescribed, by the native practitioners, in the form of an electuary, in consumptive complaints and coughs of long standing, to the quantity of a small teaspoonful twice daily. The juice of the tender shoots of the plants they administer to children to clear their throats of viscid phlegm. The plant is cultivated in great abundance at Cumbum, and on the Vursenand Mountains in the Dindigul District."

Description.—Root perennial, stoloniferous. Stolones as thick as the little finger, running under the ground, inserted in sheathing scales. Stem none. Leaves radical, from four to eight, the exterior ones shortest, spreading most, and considerably broader, the interior ones nearly erect, from 1—4 feet long, semi-cylindric, grooved on the upper side, each ending in a round, tapering, sharp point; they are all coloured with deeper and lighter green, and somewhat striated, but otherwise are smooth. Scapes issuing from the centre of the leaves, from 1—2 feet long, including the raceme, or flower-bearing part, erect, round, smooth, about as thick as a small ratan, between the raceme and the base these are at regular distances, four or five pointed, alternate sheaths. Racemes erect, about as long as, or longer than, the scape below the flowers, striated, smooth. Flowers middle-sized, greenish-white, erect, collected in fascicles of from 4 to 6, on little, regularly distant tuberosities of the rachis. Bracts small, membranaceous. Pedicels clubbed, short, ascending, one-flowered. Calyx none. Coralla one-petalled,

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not in the least wrinkled, funnel-shaped, half six-cleft; divisions nearly linear. Filaments length of the divisions of the coralla, and inserted into the base. Anthers linear-oblong, incumbent, half two-cleft. Germ 3-lobed, 3-celled, each containing a single ovule, attached to the axis. Style length of the stamens. Stigma 3-sided, clubbed, entire. Berries 1—3, slightly united; when single, globular, fleshy, orange-coloured, smooth, the size of a pea, one-seeded. Seed globubar. Embryo simple, lodged near the base of the perisperm on the outside. (*Roxburgh.*)

Chemical composition.—An alcoholic extract from the fresh roots was mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, ether, then rendered alkaline and reagitated with ether.

The petroleum ether left on spontaneous evaporation a viscid, slightly greenish-yellow residue, with a ginger-like odour, similar to that of the fresh roots. The extract was partly soluble in absolute alcohol, the solution possessing a pungent ginger-like taste and acid reaction. The portion insoluble in alcohol was white and had the properties of a wax.

The acid ether extract had a fragrant vanilla-like odour and was yellowish-green. It contained salicylic acid, a yellow neutral bitter resin, a greenish acid resin, traces of an alkaloid, and a white neutral principle, slightly soluble in cold absolute alcohol: the nature of this principle was not ascertained. The alkaline ether extract contained a crystallizable white alkaloid, affording a slight yellowish-red colour with Fröhde's reagent in the cold, changing to blue on warming; and, with nitric acid, a faint yellow coloration. We provisionally name this alkaloid *Sanseverierine.*

HERMODACTYLUS.

Vernacular.—Surinján (*Ind. Bazars*).

History, Uses, &c.—The Hermodactyl, or "Finger of Hermes," was unknown to the early Greeks; it appears to have been first used medicinally by the Arabs or later Greek

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physicians; it is first mentioned by Alexander of Tralles, who flourished A.D. 560. (Lib. XI.) It is deserving of special notice that under the name of Surugen or Hermodactyl, Serapion comprehends the κολχικον and εφημερον of Dioscorides and the ερμοδακτυλος of Paulus Ægineta.* (*Pereira*, Vol. II., Pt. I., p. 166.) Masih and other early Arabian writers describe three kinds of Hermodactyl, the white, yellow, and black; in this they are followed by most of the more recent Mahometan writers. According to Ibn Sina, the flower of the Surinján is the first flower which appears in spring in the moist valleys beneath the mountains; the leaves, he says, lie flat upon the ground, the flowers are yellow and white. Mír Muhammad Husain states in the *Makhzan* that the white is the best, and that it is not bitter; next the yellow; both may be used internally; the black, he says, is poisonous and only to be used externally. He describes the Hermodactyl plant as having leaves like a leek and a yellow flower; it is called in Persia *Shambalíd;* the black variety, he says, has red flowers.

Aitchison states that the corms of *Merendera persica* (Boiss.), a plant with pale pink or white flowers, are sold at Meshed as *Shambalid*, and are one of the kinds of Hermodactyl; they may occasionally be mixed with those of *Colchicum speciosum* (Stev.), also a common plant in the Badghis and Khorasan. The Kashmir Hermodactyls (Surinján-i-talk) are, he says, undoubtedly the corms of *Colchicum luteum* (Baker). Mahometan physicians consider the drug to be deobstruent, alterative, and aperient, especially useful in gout, rheumatism, liver, and spleen. In gout they combine it with aloes: with ginger and pepper it is lauded as an aphrodisiac; a paste made of the bitter kind with saffron and eggs is applied to rheumatic and other swellings; the powdered root is sprinkled on wounds to promote cicatrization. Two kinds of Surinján are met with in Indian shops, *bitter* and *sweet*. European physicians in India who have tried the drug consider the sweet Hermodactyl to be inert or nearly so, and the bitter to have properties similar to Colchicum. (*Phar. of India*, p. 246.)

* Conf. Dios. iv., 82, 83. Paulus Æ. iii., 78.

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Description.—Súrinján-i-shírín, or tasteless Hermodactyl. Speaking of this drug as furnished to him from India by Dr. Royle, Pereira says:—"In their general form these corms resemble those of *Colchicum autumnale*. They are flattened, cordate, hollowed out or grooved on one side, convex on the other. At their lower part (forming the base of the heart) is a mark or disc for the insertion of the root fibres. Their size varies; the specimens I have examined were from ¾ to 1½ inch in length or height, 1 to 1½ inch in breadth, and about ½ an inch in depth. They have been deprived of their coats, are externally dirty yellow or brownish, internally white, easily broken, farinaceous, opaque, odourless, tasteless, or nearly so, and worm-eaten. They agree precisely with Hermodactyls furnished by Professor Guibourt."

"Súrinján-i-talkh, or bitter Hermodactyl. The corms of this variety are distinguished from the preceding by their bitter taste, their smaller size, and by having externally a striped or reticulated appearance. Their colour for the most part is darker; in some specimens it is blackish. One corm is ovate cordate, one inch in height or length, ¾ of an inch broad, and about ¼ inch thick, grooved or hollowed on one side, convex on the other; of a brownish-yellow colour, semi-transparent, has a horny appearance, and is marked by longitudinal stripes, indicating a laminated structure. A second is opaque, amylaceous, reticulated externally, white internally, less flattened and of a remarkable shape, the concave or hollow side of the corm being continued half an inch below the mark for the attachment of the root fibres." (*Mat. Med.*, Vol. II., Pt. I., p. 167.) Pereira's description agrees exactly with the Hermodactyls which we have examined.

Microscopic structure.—The starch grains of the tasteless Hermodactyl are large and muller-shaped, with a distinct hilum. The starch of the bitter kind is angular by compression of the cells, and appears to be broken as if by heat.

Chemical composition.—Lecanu has analysed the tasteless variety, and obtained the following result:—Starch (forming the

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bulk of the drug), fatty matter, yellow colouring matter, gum, supermalates of lime and potash, and chloride of potassium.

We have made comparative analyses of the Bitter Surinjan from Lahore and the Sweet Surinjan (*Merendera persica*).

	Bitter.	Sweet.
Ether extract	1·31	·69
Alcoholic extract	·54	6·23
Water extract	12·56	12·52
Starch	65·00	65·90
Cellulose	8·64	3·56
Ash	2·20	2·15
Moisture	9·75	8·95

The ether extract of the bitter Surinjan contained a resin giving a rose-red colour with sulphuric acid. The ether extract of the sweet kind consisted of fat. Both drugs contained an alkaloid giving precipitates with tannin and the usual reagents, and both contained an organic acid related to malic acid. A much larger quantity of Fehling reducing principle was present in the sweet than in the bitter drug, and this is shown in comparing the amounts of extract dissolved out by alcohol.

Commerce.—Bitter Hermodactyls are imported into India from Kashmir. The sweet kind comes from Persia. Value, Re. 1-4-0 per lb.

Substitute for the Bitter Hermodactyl.—The sliced bulb of *Narcissus Tazetta* (the true Narcissus), a plant which, when in bloom, covers like a white carpet great portions of the plains of Behbehám and valley of Sha'b-bawan in Persia, is imported into India as bitter Hermodactyl.

It may be at once detected by its larger size and tunicated structure. The taste is bitter and acrid, the substance amylaceous and very similar to that of the Hermodactyl. The starch grains are rounded and not compressed. It is used as an external application, and, according to the author of the *Makhzan*, has properties very similiar to those of Súrinjan-i-talkh. The several species of Narcissus (Gr. νάρκισσος)

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have a similar action. Pliny describes their emetic, purgative, maturative, and drying powers, and, referring to their soporific virtue, says, "et a narce narcissum dictum non a fabuloso puero." The Arabs give a similar account of them. Orfila's experiments upon dogs show that they act as local irritants, and also exert a depressant and paralysing effect upon the brain and whole nervous system. In man small doses are emetic; recently from 15 to 30 grains of the flowers of the common daffodil have been recommended as an emetic for children.

The following is an analyses of the corms of *Narcissus Tazetta*:—

Ether extract	·39
Alcoholic extract	1·02
Water extract	10·24
Starch	71·86
Cellulose	3·84
Ash	1·90
Moisture	10·75

The ether extract was fragrant and greasy. The alcoholic extract contained an alkaloid, bitter and acrid in taste, and a resin. Malic acid was present.

HIRANYA-TUTTHA.

This substance bears a Sanskrit name हिरण्य तुत्य "golden collyrium," which, in the vernaculars, is converted into Haran-tuttha or Haran-tutiya. It is a medicine of great repute in Afghanistan and Northern India, and is a dark-brown dry extract, sold in small pieces, which is prepared from the corms of *Colchicum luteum* (Baker), and possibly from other species of Colchicum. In Sanskrit Tuttham or Tutthánjana is a term applied to collyria made of sulphate of copper or of the root of a plant with a yellow flower, which has by some been supposed

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to be a Curcuma, but which is undoubtedly *Colchicum luteum*, a plant found in the Punjab, Afghanistan, and Kashmir. C. Masson, in his narrative of an Excursion into the Hazareh Country in 1832 (*Trans. Bombay Geograph. Soc.* ii., p. 60), notices a small bulbous root, which the Afghans dug up at Bád Assiar on the banks of the Helmund, and which appeared to be a kind of Colchicum, for the purpose of preparing *Haran-tuttha*, a medicine of great repute among the Afghans. He also remarks:—"It is sold in small pieces of a dark-brown colour, and resembles a dry extract." Masson travelled through a great part of Afghanistan on foot, mixing with all classes of the people, and his experience of their manners and customs is very interesting.

SMILAX CHINA, *Linn.*

Fig.—*Kæmpfer Amæn.*, *t.* 782. China root (*Eng.*), Squine (*Fr.*).

Hab.—China.

SMILAX GLABRA, *Roxb.*

Fig.—*Seeman, Bot. of the Herald, tt.* 99—100.

Hab.—Sylhet, Garrow Hills, S. China. The tuberous roots.

Vernacular.—Chob-chini (*Ind. Bazars*), Too-fuh (*Chin.*), San-kira (*Japan*), Cay-khuc-khac (*Coch.-Chin.*), Paringai-puttai (*Tam.*), China-pagu (*Mal.*).

History, Uses, &c.—This drug was introduced into Goa from China about A.D. 1535 (*Garcia*). Previous to this date it is not noticed by any of the Mahometan physicians. The Portuguese, however, appear to have lost no time in carrying it to their factories in Persia, as it was mentioned, a few years after its introduction into Goa, by Mir Imad-ed-din Mahmud of Shiraz, Mirza Kázi of Yezd, and Mir Muhammad Háshim of Teheran. In 1669 it was described as a well-known drug in the *Tuhfat-el-muminin* under the name of Chúb-chini

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(Chinese wood), in Arabic Khashab-es-sini. The author of the *Makhzan-el-Adwiya* has a long article upon its medicinal virtues. He also notices particularly the variable appearance of different samples of the drug, and directs that what is heavy, of a rosy colour, and free from knots is to be selected. He tells us that the fresh root is sometimes brought to India; some of this he planted at Moorshedabad (A. H. 1178); it produced a climbing stem with small elongated leaves, not unlike a bamboo; after a year's time he dug it up, but found that the roots had degenerated and did not retain the qualities of the China article. Chub-chini is considered by these writers to be anti-rheumatic, anti-syphilitic, aphrodisiacal, and demulcent. Loureiro says of it, "valet in quibuscunque doloribus vagis, venereis, aut rheumaticis."

Ainslie (*Mat. Ind.*, i., 70) notices its use in Southern India as an anti-syphilitic and as a remedy of much repute in a disease called *maygum vaivoo*, in which the limbs are stiff and contracted. He also states on the authority of the Abbé Rochon* that "the Chinese often eat the root instead of rice, and that it contributes to make them lusty." Roxburgh states that the *Smilax glabra*, a native of Sylhet and of the adjacent Garrow country, where it is called *Hurina-shook-China*, has large tuberous roots, not to be distinguished by the eye from China-root, and that the natives of the country use a decoction of the fresh root for the cure of sores and venereal complaints (*Flora Indica*). This plant also grows in China and affords some of the China-root of commerce. (Trimen's *Journ. of Bot.*, i., 102.)

The reported good effects of China-root on the Emperor Charles V., who was suffering from gout, acquired for the drug a great celebrity in Europe, and several works were written in praise of its virtues. But though its powers were soon found to have been greatly over-rated, it still retained some reputation as a sudorific and alterative, and was much used at the end of the 17th century in the same way as sarsaparilla. It still retains a place in some modern pharmacopœias. (*Pharmacographia.*)

* Voyage to Madagascar and the East Indies, London, 1792.

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In the East, Chub-chíní is still as highly esteemed as it ever was, and the China Trade Returns show a steady yearly increase in the quantity shipped from Southern China.

Description.—The tubers, which are formed upon the fibrous roots of the plant, are of the shape and size of an elongated kidney potato, somewhat flattened, knotty, covered with a rusty-coloured bark, sometimes smooth and shining, sometimes rough; internally their substance is of a pinkish-white colour, hard and farinaceous, insipid, mucilaginous and inodorous.

The drug is usually peeled and trimmed, and consequently is of irregular form, resembling a piece of heavy pinkish-white wood.

Microscopic structure.—The bark consists of thick-walled dark-brown brick-shaped cells, which contain bundles of crystalline needles and resinous matter. The bulk of the tuber is made up of a parenchyma, the cells of which are large, thin-walled, and loaded with starch, some pink colouring matter is also present. The starch grains are large and have a radiate hilum. The vascular system is scalariform, and is associated with porous wood cells.

Chemical composition.—The authors of the *Pharmacographia* endeavoured to obtain from the drug *Parillin*, the crystalline principle of sarsaparilla, but without success.

A proximate analysis of the air-dried drug afforded :—

Ether extract (fat)	0·33
Alcoholic extract (sugar, glucoside)	1·72
Aqueous extract (sugar, gum, &c.)	6·79
Crude fibre	13·79
Ash	1·47
Moisture	6·10
Starch (by difference)	69·80
	100·00

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This root contained no alkaloid, but the alcoholic extract contained a glucoside, and a colouring matter which gave an olive-green tint with ferric chloride, but no precipitate with gelatine. With soda it afforded a deep red colour, and was precipitated from solution by neutral plumbic acetate. The sugar present abundantly reduced Fehling's test without previous inversion. The amount of ash, consisting of alkaline salts is very small.

Professor Kobert has recently separated from true sarsaparilla three glucosides, smilacin, sarsasaponin, and parillin,—these compounds differ in physiological activity,but are members of a homologous series to which has been assigned the general formula $C^n H^{2n-8} O^{10}$.

Commerce.—From 16,000 to 17,000 peculs of 133 lbs. each are annually produced in Southern China. The greater part is consumed in China, but a very considerable portion must reach India, as the drug is to be found in every bazar throughout the country.

Smilax ovalifolia, *Roxb.*, *Rheede, Hort. Mal. vii., t.* 31, Janglí-ushbah (*Hind.*), Malai-támara (*Tam.*), Konda-támara (*Tel.*), Gútwel, Gúti (*Bomb.*), Kal-támara (*Mal.*), is a climbing shrub very common in the Concans. The roots are very numerous, and have a general resemblance to sarsaparilla. A section shows a dry, suberous, brown bark; secondly, one row of 5-sided yellow cells, which are more or less wedge-shaped, their nuclei being situated towards the apices; thirdly, a range of numerous rows of ovoid cells, variable in size, with central nuclei; these extend as far as, and partially surround, the vascular zone, which consists of large vessels with generally two smaller ones in contact with them. Within the vascular zone the central portion of the root is made up of large thin-walled cells, filled with starch or red colouring matter; the latter is most abundant in young roots. The drug is not used by the natives, but in Goa it is kept in all the shops, and is the country sarsaparilla of the Portuguese.

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DRACÆNA CINNABARI, *Balf. f.*

Fig.—*Balf. f. in Trans. Roy. Soc. Edin. xxxi.*, Tab. xcvi—xcvii. Dragon's blood (*Eng.*), Sang-dragon (*Fr.*).

Hab.—Socotra. The resin.

Vernacular.—The tree—Kharya (*Socotra*). The resin—Dam-khoheil, Edah (*Socotra*), Dam-el-akhwain (*Arab.*, *Ind. Bazars*), Hira-dukhi (*Hind.*), Hira-dakhan (*Bomb.*), Kándamurgarittam (*Tam.*), Katgamurgam-nitúru (*Tel.*).

History, Uses, &c.—On the Deir-el-Bahari monument at Thebes, erected by Hatasu, a queen of the 18th dynasty, who lived about 1700 B.C., there are representations showing the commissioner of the queen going over the sea to the country of Punt and of 'To Nuter,' and bringing therefrom, amongst other things, plants bearing 'Ana,' which is shown as a gum or resin in the form of red tears on the stems of small trees with ovate-lanceolate leaves. The To Nuter of the inscription has been identified with the Sacred Islands of Pliny, and the modern archipelago, including Socotra. The gum or resin is probably dragon's blood, as that is the most remarkable substance of the kind produced on the island. The author of the Periplus of the Erythrean Sea, A.D. 54-68, mentions κιννάβαρι as a production of the island of Dioscorida, the ancient Greek name of Socotra. Dioscorides (v. 63) notices its medicinal uses under the same name, and states that it is produced in Libya (Africa). Both he and Pliny (33, 38) distinguish it from the mineral cinnabar; the latter writer states that the price of genuine cinnabaris is fifty sesterces per pound. A myth was current among the Greeks and Romans that this substance was the blood of the dragon or python crushed beneath the weight of the dying elephant, round which it had wound itself to suck the animal's blood. Rufus Ephesius and Galen notice the use of the drug for stopping hæmorrhage from wounds.

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Among the Arabs it bears many names, such as Dam-el-akha-wain, Shayyán, Aidá vulg. Edá, Dam-el-tinnín, and Dam-el-thuabán "dragon's blood," Elándam, Kátir-ed-dam, and later El-kátir-el-makki vulg. Katr-makkeh. Johanna-bin-Masawiyeh, physician to the Caliph Haroun-el-Rashid, specially recommends it for strengthening the stomach and liver, and as an astringent ingredient in collyriums. On account of its use as a collyrium, the Arabs sometimes call it Dam-kuhl or simply Kuhl "collyrium."

Among the Persians it is known as Khún-i-siyáwash, and they have a myth that when Afrásiab killed Siyáwash, this plant sprung up upon the place where his blood was shed. The author of the *Burhán*, who relates this story, also remarks that the gum is said to come from Africa. Haji Zein (1368) notices three qualities of dragon's blood, *viz.*, Chakideh 'drop,' Turábi 'earthy,' and Khashabi 'mixed with wood.' He says it is not the gum of the *bakam* (*Cæsalpinia Sappan*) as supposed by some, but of a tree growing in Africa. The author of the *Tuhfat-el-muminín* states that the plant which produces it is not known; he notices its use for painting glass. The author of the *Makhzan* (1770) merely repeats what older writers have said.

Ainslie (*Mat. Ind.*, i., 113) remarks that it is often confounded with Kino by the native doctors of Lower India. The Tamool doctors recommend a solution of it in arrack as an external application to the head and temples in cases of syncope.

Although the early European travellers in the East mention Socotra dragon's blood, Guibourt and Pereira do not notice it, and nothing exact regarding its source was known until Wellstead (*Journ. Roy. Geog. Soc.*, v. (1835), 198) described the tree, but wrongly supposed it to be *Pterocarpus Draco.*

Professor Bayley Balfour, who visited Socotra a few years ago to examine the fauna and flora of the island, was the first

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to give us any exact information concerning the species of Dracæna yielding dragon's blood in Socotra, and the way in which it is collected. He says, the resin exudes most abundantly immediately after the rainy season; the natives collect it by chipping it off with a knife into a small bit of skin placed against the tree; there are different qualities collected: 1*st*, the large tears, which are the best and most expensive, and are called *Edah amsal* (ايدع امثال best Edah); 2*nd*, small portions which become detached, forming powdery dragon's blood or *Edah dukkah* (ايدع دقه Edah dust); 3*rd*, an inferior kind, obtained by melting the refuse into cakes, called *Edah mikdhah* (ايدع مقدحه Edah of the ladle).

Description.—The best quality may at once be distinguished by its occurring in tears, the surface of which is covered by a dull red powder. When broken, the surface is glassy, translucent, and of a beautiful garnet colour. Imitation tears are manufactured in India from the powdery dragon's blood; they may easily be detected by their wanting the glassy fracture of the genuine article. Cake dragon's blood is also met with; it is of a dull red colour, and contains fragments of barkwood, and other refuse.

Chemical composition.—See *Calamus Draco.*

Commerce.—The drug is imported into India through Bombay.

Zanzibar Dragon's blood is similar in appearance to that which comes from Socotra, and is not distinguished from it in Indian trade. Hildebrandt has ascertained that it is obtained from the stems of *Dracæna Schizantha* (Baker).

The natives remove pieces of the bark about two inches square, and the cavity in two to three weeks' time becomes filled with the resin. In Zanzibar it is used in ophthalmia, and is said to be called "Macziwa ya watu wawili," meaning the milk of two men, or "Matcho ya watu wawili," the eyes of two men.

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BROMELIACEÆ.

ANANAS SATIVA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1554; *Rheede, Hort. Mal. xi.*, *t.* 1. Pine-apple (*Eng.*), Ananas (*Fr.*).

Hab.—America. Cultivated throughout the East. The fruit and leaves.

Vernacular.—Anannás (*Hind.*), Anánas, Anúras (*Beng.*), Annás, Aunás (*Mar.*), Anáras (*Guz.*), Anásha-pazham (*Tam.*), Aṇása-pandu (*Tel.*), Kaita-chakka, Parangi-chakka (*Mal.*), Anánasu-hannu (*Can.*).

History, Uses, &c.—The Pine-apple was unknown in India prior to the discovery of America; it was first made known to Europe by Hernandez in 1513, and was introduced into India by the Portuguese from Brazil in 1594. Its introduction is mentioned by Abu Fazl in the *Ayeen-i-akbari*, and also by the author of the *Dára Shakoh.* The vernacular names are mostly derived from the American names *Anasi* and *Nanas*, but the Malabar name Parungi-chakka signifies "European Jack fruit." Rheede states that in Malabar the leaves boiled in rice-water and mixed with *Pulvis Baleari* afford a drink which is given to dropsical patients to purge off water; the unripe fruit is given with vinegar to cause abortion and to relieve flatulent distension of the abdomen. The author of the *Makhzan-el-Adwiya* describes two kinds of pine-apple, *viz.*, the ordinary kind, and a small kind of superior sweetness and flavour called *Kaunla.* He says that the fruit is cold and moist, suitable to those of a bilious temperament, but not to the phlegmatic; to lessen its coldness it should be cut in thin slices and washed in salt and water and afterwards in pure water; it may then be sprinkled with sugar and rose-water and eaten. A little ginger is also said to render the fruit more wholesome. Pine-apple chutney, preserve, and sherbet are also mentioned, but nothing is said about the

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medicinal use of the leaves and unripe fruit. From the special opinions of medical officers in India recorded in the *Dict. Eco. Prod. of India* (i., 238), it appears that a belief in the abortifacient properties of the leaves and unripe fruit is common throughout India among the natives.

Chevers (*Med. Juris.*, p. 715), on the authority of Babu Kanny Lall Dey, has the following description of its use in Bengal:—"A green, unripe one, only half-grown is used. It is decorticated, and the pulpy mass of a whole one is administered to the woman with a small quantity of salt. It is efficacious only during the earlier months of pregnancy; and, after the third month, its action is very doubtful. But, if administered to suitable cases, the uterus begins to contract within twelve hours, when slight hæmorrhage occurs also. Its action then increases, and within the course of twenty-four hours the ovum is expelled. Occasionally the woman's life is jeopardized by flooding, but, as a rule, there is not much danger to be apprehended." Again, at page 718, Chevers says: "A note which I have from Babu Koylas Chunder Chatterjee renders this matter plain. He says that acid fruits are regarded as abortives. He knew a case in which a woman aborted at an advanced stage of pregnancy by eating (with that intention) about two pounds of ripe pine-apple. This fruit is rendered unwholesome by the presence of a very strong fibre which acts as a mechanical irritant on the bowels. I had under my own care an English lady who died of dysentery, after having aborted, at about the fifth month of pregnancy. The cause of her illness appeared to be the ravenous eating of raw pine-apple."

Description.—The plant is biennial, not unlike an aloe, but the leaves are much thinner, and of a hard fibrous texture, with numerous short sharp spines on the edges. The fruit is produced on a short stem which rises from the centre of the plant, and bears a scaly conical spike, surmounted by a number of small spiny leaves called the crown. This conical spike bears a number of small bluish flowers having three petals and a 3-parted calyx; after flowering, it gradually enlarges and eventually becomes a succulent fruit of a rich orange-yellow colour.

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Chemical composition.—The essence of pine-apple is prepared artificially by mixing butyrate of ethyl with 8 or 10 parts of spirit of wine. Pine-apple juice contains a proteid-digesting ferment. Three fluid ounces digest 10 to 15 grains of coagulated albumen; it acts equally well in acid and alkaline solutions, and best in a neutral fluid. The juice also contains a milk-curdling ferment.

The ash has the following composition:—

Potash	49·42	per cent.
Magnesia	8·80	„
Lime	12·15	„
Phosphoric acid	4·08	„
Sulphuric acid	trace.	
Silica	4·02	„
Phosphate of iron	2·93	„
Chloride of sodium	17·01	„
Chloride of potassium	·88	„

(Quoted by Kensington in *Chemical Composition of Foods, &c., &c.*)

COMMELINACEÆ.

COMMELINA BENGALENSIS, *Linn.*

Fig.—*Clarke, Comm. et Cyrt.*, 14, pl. iv.; *Wight Ic., t.* 2065.

Hab.—Bengal, Peninsula, Sind, Concan. The herb.

Vernacular.—Kánchara (*Hind.*), Káchrádám, Kánchara (*Beng.*), Chura, Kanna (*Punj., Sind*), Kena (*Mar.*), Kanang-karai (*Tam.*), Venna-devi-kura, Niru-kassuvu (*Tel.*), Hittaganí (*Can.*).

History, Uses, &c.—This and several other species of Commelina are included under the Sanskrit name of Kanchata. They are small herbaceous plants which appear everywhere towards the end of the rainy season and are remarkable for their brilliant blue flowers. The stems, roots, and seeds which

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contain much mucilage and starch are used on account of their demulcent properties, and are eaten in times of scarcity. *C. communis* is said by Loureiro to be refrigerant and laxative, and to be useful in strangury and costiveness.

Tradescantia axillaris, *Willd., Rheede, Hort. Mal. x., t.* 13. A very similar plant, and often called by the same vernacular names, has similar properties, and its seeds have frequently proved to be a valuable resource in times of famine. Ainslie notices it under the Tamil name of Nirpulli (*Mat. Ind.*, ii., 250).

Lyon found the seeds to have the following percentage composition:—Water 10·26, fat 0·62, albuminoids 15·99, carbohydrates 54·79, cellulose 9·36, ash 8·89. The nitrogen was estimated at 11·28 grains per oz., and the nutritive carbon at 145·80 per oz. He calculates the nutritive value of the seeds as compared with the average cereal at 100·00 to be 85·76.

XYRIDEÆ.

XYRIS INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 71.

Hab.—Salt marshes in Bengal, S. Concan, and Coromandel. The herb.

Vernacular.—Dádmári (*Hind.*), China-ghauza, Dábi-dúba (*Beng.*), Kochilítti-pullu (*Tam.*), Kochilachi-pulla (*Mal.*).

History, Uses, &c.—Xyris (ξυρίς) is a name given by Dioscorides (iv., 24) to a species of Iris, which has been identified with *fœtidissima*, Linn. Pliny (21, 83) speaks of the same plant as the wild Iris called by some Xyris; it appears to have been applied locally to disperse scrofulous swellings and to promote the healing of sores, and given internally as a diuretic and alterative. Linneus transferred the name to a genus of flag-like plants growing in the East and West Indies. *X. indica* does not appear to be mentioned in any of the standard native medical works, but Rheede notices its use in Malabar in

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the following terms:— "Foliorum succus cum aceto mixtus impetigini resistit; folia cum radice oleo incocta contra lepram sumantur; cum *mungo* (*Phaseolus Mungo*, Linn.) decocta et epota somnum consiliant." Agardh, the Swedish botanist, notices its use as a remedy for itch and leprosy. Ainslie gives the plant a place in his *Materia Indica* (ii., 125), but merely repeats what Rheede has already said. Roxburgh gives a full description of it, and remarks on the authority of the Hon'ble J. Hyde that "the natives of Bengal esteem it a plant of great value, because they think it an easy, speedy, and certain cure for the troublesome eruption called ringworms."

Description.—Root fibrous, annual; leaves radical, bifarious, straight, sword-shaped, on one edge slit into a sheath for the scape, pointed, smooth, 6—12 inches long; scape naked, round, striated, erect, length of the leaves, each supporting a round, flower-bearing head; flowers, bright yellow; bracts 1-flowered, orbicular, concave, hard, smooth; calyx 3-leaved, hid within the scale, membraneous; petals three, each supported on an unguis just long enough to raise their expanding, oval, crenate borders above the scales; filaments three; anthers twin; germ superior, 3-sided; style 3-cleft; stigma torn; capsule 3-valved, 1-celled; seeds numerous. (*Roxburgh.*)

Chemical composition.—The plant contains a red colouring matter soluble in alcohol and intensified by alkalies and having some reactions peculiar to chrysophanic acid.

PALMÆ.

COCOS NUCIFERA, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 73; *Rheede, Hort. Mal. i., tt.* 1 to 4. Cocoanut (*Eng.*), Cocotier (*Fr.*).

Hab.—Indian Archipelago and coasts of India. The flowers, fruit, shell, oil, juice, tomentum, root, and ash.

Vernacular.—Nárryal (*Hind., Beng.*), Náriyál (*Guz.*), Núral, Nárali mád (*Mar.*), Tenha, Tenna-maram (*Tam.*), Nári-kadam,

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Tenkaya-chettu (*Tel.*), Tengina-gida, Tengino-káyi (*Can.*), Tenga, Ten-maram (*Mal.*).

History, Uses, &c.—The cocoanut, formerly written coconut, derives its European names from the Portuguese *coco*, "a mask." Garcia ab Horta says: "We have given it the name of *coqus* on account of its having three holes which cause it to resemble the face of a cat or similar animal." The resemblance, however, of this nut to a head and face had not escaped the notice of the Hindus; long before the Portuguese had set foot in India, *náral* was used as a cant term in the sense of head, pate, sconce, &c., and was sometimes used to represent the head of a dummy figure by the relatives of a deceased person whose body could not be found, and who nevertheless were desirous of rendering to it the usual funeral rites. Various superstitious uses to which the cocoanut is put in India attracted the notice of the early missionaries. Vincenzo Maria da Santa Caterina (*Viaggio alle Indie Orient.*, iii., 29) states that when an Indian falls sick, they spin a cocoanut; if it stops with its face towards the West, the sick person will die, but if it faces the East, he will recover; he also notices the offering of a cocoanut at the commencement of any building. To this we may add that on the Western Coast cocoanuts are offered to the Sea on the day of the full moon of Shravan, when the monsoon is supposed to terminate. It is related that in former days the European Governor of Bombay used to go in state and throw a golden cocoanut into tho sea on this day. In Hindustan there is also a practice among the Indian Mahometans of breaking a cocoanut to ascertain whether a pregnant woman will be delivered of a male or female child; if it is empty she will be delivered of a son, if not, of a daughter: this is called "nariyal torna." Breaking a cocoanut against the wall of a person's house is in Western India an indication of enmity to the inmates of the house, and is connected with the practice of smelling the heads of children before allowing them to leave the house. The *utarna* or casting away of disease or misfortune may be performed by carrying a cocoanut to a distance from the house and breaking it.

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Among the Hindus the most important function of this nut is at marriages, when it is the custom to place the *tâli* of the bride, which the parents must see and touch in token of their approbation of the marriage, in the half of a broken cocoanut. Here the *táli* and nut represent *le jeu des époux*. De Gubernatis relates that the continuance of this practice among their converts greatly exercised the patience of the Jesuit missionaries, and that the matter was finally settled in 1704 by a decree of the Cardinal de Tournon to the following effect:— "Fructus etiam vulgo dictus Coco, ex cujus fractione prosperitatis vel infortunii auspicia gentiles temere ducunt, vel omnino a Christianorum nuptiis regiciatur, vel saltem, si illum comedere velint non publice sed secreto et extra solemnitatem apariatur ab iis qui, evangelica luce edocti, ab hujusmodi auspiciorum deliramento sunt alieni." In the coast districts, cocoanuts and sugar-cakes (*náral, batása*) are lavishly distributed to the guests on important festive occasions, such as marriage, the *phool* ceremony on the event of the first menstruation and first pregnancy, and the thread ceremony; in other parts of India their place is supplied by betel-nuts. In Europe nuts appear to have been always regarded as auspicious and symbolical of fertility; the Romans scattered nuts at weddings; Virgil says, "Sparge, marite, nuces," and De Gubernatis states that this custom still exists in several parts of Southern Europe; in Piedmont there is a proverb: *Pan e nus vita da spus.*

The economic uses to which the cocoanut tree and its products are put in the East, are so numerous, and have so often been described, that we will not attempt to recapitulate them, but refer the reader to the *Dictionary of the Economic Products of India* (ii., 415). At the Colonial and Indian Exhibition, Mr. M. C. Pereira, Head Assistant to the Government Medical Storekeeper, Bombay, exhibited a collection of eighty-three articles prepared from the tree, and we are informed that he has since added considerably to his collection.

Sanskrit medical writers describe the tree under the name of Nárikela or Nárikera, and give it many synonyms, such as Tunga "lofty," Trina-rája "king of grasses," Skandha-taru

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"stem tree," Dur-ároha "difficult of ascent," Kúrcha-sekhara "crowned with a bunch of fruit," Dridha-phala "having hard fruit," Rasa-phala "having juicy fruit," Dridha-nira "having strong juice," &c. The tree also bears the name of Langala "membrum virile."

Dutt (*Mat. Med. of the Hindus*, p. 247) gives the following summary of the medicinal uses of the cocoa palm mentioned in Sanskrit medical works:—"The water of the unripe fruit is described as a fine-flavoured, cooling, refrigerant drink, useful in thirst, fever, and urinary disorders. The tender pulp of the fruit is said to be nourishing, cooling, and diuretic. The pulp of the ripe fruit is hard and indigestible, but is used medicinally in the preparation called *Nárikela-khanda.* The terminal bud of the tree is esteemed as a nourishing, strengthening, and agreeable vegetable. The root of the tree is used as a diuretic, and also in uterine diseases. The oil is said to promote the growth of the hair and to prevent it from turning grey, and is much used by native women; in Bengal it is scented and sold under the name of *Múthághasá.* The ashes of the leaves are used in medicine, and contain much potash. The fresh juice of the tree is considered refrigerant and diuretic; when fermented it constitutes one of the spirituous liquors described by the ancient writers. The cleared shell of the nut is burnt in the fire, and when thoroughly ignited covered up in a stone cup, the fluid thus obtained is rubefacient, and is an effectual domestic remedy for ringworm. The nárikela-khanda already mentioned is made in the following manner:—Take of the pounded pulp of cocoanut half a sér, fry it in eight tolas of clarified butter, and afterwards boil in four sérs of cocoanut water till reduced to a syrupy consistence. Now add coriander, long-pepper, bamboo manna, cumin and nigella seeds, cardamoms, cinnamon bark and leaves, cyperus root and the flowers of *Mesua ferrea,* one tola each in fine powder, and prepare a confection. The dose is two to four tolas, in dyspepsia and consumption.

The cocoa palm is supposed by some to have been the κουριοφόρον (δένδρον) of Theophrastus (H. P. iv., 2, 7), and the

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Cuci of Pliny (13,19), but their description appears to agree better with the *Hyphæne coriacea* or Doom palm of Egypt. The Arabs call the cocoanut Nárjil, and the Persians Nárgil, Bádinj, and Ránaj; their physicians describe it as hot and dry, nutritive and aphrodisiacal, beneficial to those suffering from piles; the kernel when it has been kept for some time is considered to be anthelmintic. They remark that it is not easily digested, especially when old.

European physicians, who have practised in India, recommend the water contained in the unripe fruit as a cooling, refrigerant drink, useful in fever and urinary disorders. The milky fluid obtained by pulping the unripe kernel and expressing it has been recommended as a nutritive diet in debility and cachexia; in large doses it is aperient, and Mr. Wood has suggested its use as a substitute for castor oil. (*Pharmacopœia of India.*) The anthelmintic properties of the cocoanut noticed by Mahometan writers have been confirmed by European observers; the dose is the rasped kernel of a single nut, followed by a dose of castor oil. Cocoanut oil has been recommended as a substitute for cod liver oil, but its prolonged use is said to induce disturbance of the digestive organs and diarrhœa; this objection may be removed by using the olein separated from the solid fats, as is done by the natives in the preparation of what they call *muthel* or hand oil. To prepare this the kernel of the fresh nuts is pulped and strained and the oil separated from the milky fluid by heating it; a preparation of the same kind is now known in Europe as *coco-olein.* Cocoanut oil is not suitable as a vehicle for liniments, but the soap prepared from it, and known as *marine soap,* may be used in plaster-making and in the preparation of soap liniment; it is freely soluble in spirit. A purified cocoanut oil has of late years been introduced in Germany as a substitute for lard; it has been recommended to pharmacists as less liable to rancidity than lard. The saccharine juice obtained by cutting the spathe of the cocoa palm, when fermented and distilled, yields a clean spirit suitable for pharmaceutical purposes.

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Description.—The cocoa palm, which has now been introduced into all tropical countries, grows to a height of 70 or 80 feet, and has at the apex a tuft of leaves which are twelve feet or more in length and have numerous narrow rigid leaflets. The spathe, from which toddy is obtained, when undisturbed produces numerous yellowish-white flowers succeeded by the fruit, only a small proportion of which come to maturity in about twelve months from the time of flowering. The immature fruit contains a clear sweet fluid, which gradually dries up as the nut ripens. The kernel which lines the interior of the shell, after the nuts have been kept for some time, dries up and separates from it, and is then called *khopra*; from it is obtained by hot pressure or by boiling in water the cocoanut oil of commerce, which has a mild, bland taste, a pale yellow colour, and peculiar odour. In hot climates it remains fluid, but when exposed to cold, it becomes of a butyraceous consistence and white colour. Its melting point varies between 22° and 30°C; the cold pressed oil melts at 20°C. or less; the fused, thin, transparent yellowish oil congeals between 18° and 12°C. After having been heated it remains liquid for several days. The oil is readily saponified at a low temperature, the soap being white, hard, and capable of uniting with much water.

Chemical composition.—Fresh cocoanut kernel contains water 46·64, nitrogenous substances 5·49, fat 35·93, non-nitrogenous extract 8·06, lignin 2·91, ash 0·97 per cent., and when dried yields nitrogen 1·65 and nitrogen free extract 67·33 per cent. (*König in Hammerbacher Landw. Versuchssk.* Bd. 13, s. 243.) Palm sugar examined by P. Horsin Deon (1879) yielded water 1·86, cane sugar 87·97, inverted sugar 9·65, other substances 0·50 per cent., and when dried 89·64 per cent. of cane sugar. The other organic substances consisted of 1·71 per cent. reducible sugar, 4·88 gum, and 3·06 mannite and fat. (*König, Nahrungs-mittell.*)

The milk of ripe and unripe cocoanuts has been analysed by L. L. van Slyke. The weight of milk from unripe nuts varied from 230·5 to 383·7 grams, and in a ripe nut only 109·6 grams.

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The composition of the unripe milk is an average of six analyses:—

	Milk of unripe nuts.	Milk of ripe nuts.
Water at 60°	95·00	91·23
Ash	·617	1·06
Glucose..................	3·973	trace.
Cane sugar	trace.	4·42
Proteids	·133	·291
Fat	·119	·145

(*Journ. Chem. Soc.*, June, 1891.)

According to Hammerbacher, the fresh milk has the following composition:—

Water.......................................	91·50	per cent.
Albuminoids	·46	„
Fat	·07	„
Nitrogen free extractive	6·78	„
Ash..	1·19	„

The milk had a sp. gr. of 1·0442. No fatty acids were present, except, perhaps, propionic.

For the composition of cocoanut *pearls*, the reader is referred to *Nature* for 1888.

Cocoanut oil has a peculiar and highly complex chemical composition. It is largely composed of the glyceride of lauric acid, $C^{12}H^{24}O^{2}$, and contains even lower homologues (*e.g.* capric, caprylic, caproic) capable of distillation in a current of open steam, and to some extent soluble in water; but the glycerides of myristic, palmitic, and stearic acids are also present in notable proportion. On the other hand, the low iodine absorption shows that comparatively little olein or its homologues can be present. (*Allen.*)

Commerce.—In 1880-81 the foreign exports of cocoanut oil amounted to 1,888,122 gallons, valued at Rs. 20,90,797, Madras

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alone having shipped to foreign countries 1,690,520 gallons, and sent in addition to other Indian ports 1,493,756 gallons. In 1886-87 the exports were 1,099,864 gallons, valued at Rs. 13,24,589, and the imports 556,562 gallons, valued at Rs. 7,54,515. The bulk of the exports (*viz.*, 689,087 gallons) went to the United Kingdom. The imports were mainly from Ceylon (438,144 gallons), Bengal taking by far the largest proportion (*viz.*, 350,437 gallons). If to these facts an abstract of the coasting traffic be added, some idea of the present position of the cocoanut oil trade may be had. The imports coastwise were in 1888, 167,486 gallons, valued at Rs. 2,05,60,067 ; the exports were 1,942,829 gallons, valued at Rs. 20,74, 455. Of the imports, Bombay received 794,577, Burma 338,056, Bengal 131,463 gallons, and these quantities were almost entirely obtained from Madras. Cochin sent to Bombay 15,789 gallons, and to Madras 13,188 gallons. The other items to make up the total coastwise imports were unimportant. Local production added to these imports would constitute the supply from which the exports could be made, and in the case of Madras it is noteworthy that that Presidency imported practically no cocoanut oil, so that her exports to foreign countries and to other Indian ports were drawn exclusively from local supplies. With the exception of the small amounts obtained from Cochin, Bombay, &c., and some 6,000 gallons from Ceylon and other foreign countries, Madras imported no cocoanut oil. But she exported 1,754,701 gallons, of which 1,008,621 went to Bombay, 273,347 to Burma, 191,413 to Travancore, and 155,202 gallons to Bengal. But Bengal exported coastwise 8,648 and Bombay 3,454 gallons. The Bengal exports went to Burma, and the Bombay to Sind, Madras, Goa, Kattywar, &c. Adding the foreign exports to the coastwise exports and deducting total of the imports, we learn that Madras exported in 1888, 3,425,221 gallons—an amount which may be viewed as the surplus over local consumption. Turning to Bengal and Bombay, a very different state of affairs is found to prevail—the imports exceed the exports, in Bengal by 313,009 gallons, and in Bombay by 1,125,572 gallons. An enormous trade in

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cocoanut oil is done in Cochin, as will be seen from the exports for six years :—

	Europe.	India, Burma, &c.	Total Tons.
1884-85	6,613	6,066	12,679
1885-86	3,494	7,237	10,731
1886-87	4,967	5,382	10,349
1887-88	6,300	6,048	12,348
1888-89	6,193	7,775	13,968
1889-90	4,048	8,264	12,312

A very imperfect idea of the supply and demand for this oil would, however, be conveyed, were we to omit to examine the trade in dried kernel, the substance from which the oil is expressed. This is largely exported to foreign countries and sent from one province of India to another. In 1886-87 the imports were 125,222 cwts., valued at Rs. 11,76,799, and the exports 9,337 cwts., valued at Rs. 79,836. The imports come chiefly from Ceylon and the Straits Settlements, and are almost exclusively delivered in Bengal and Bombay. The exports go mainly from Madras, the greater part to Portugal, Persia, Russia, and Arabia, each receiving from 300 to 500 cwts. Of the imports by far the larger portion was received in Bombay.

Borassus flabelliformis, *Linn. Rheede, Hort. Mal. i., tt.* 9, 10, is the Palmyra palm of the English, and the Roudier a éventails of the French. In Sanskrit it is called Tála, and in the vernaculars Tál, Tád, Tár, and Panai-maram. The properties of the various parts of this noble palm are described in detail in Sanskrit medical works. The root is considered to be cooling and restorative; the saccharine juice obtained from the spathe cooling and diuretic when fresh, but intoxicating when fermented; the pulp of the ripe fruit heavy and indigestible; the gelatinous contents of the unripe seeds refreshing and cooling; the embryo of the germinating seed, and the terminal bud of the tree, are used as vegetables, and are considered to be cooling, nutritive, and diuretic; the ash of the spathe is given as a remedy for enlarged spleen.

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The spirit distilled from the juice of this palm is similar to that obtained from the cocoa palm.

The fine, brown, silky substance on the young petioles of the leaves of this and other palms is used as a styptic.

B. flabelliformis yields an insoluble gum, like tragacanth, but of a darker colour.

For an account of the economic uses of this palm, the reader is referred to the *Dict. Econ. Prod. India*, i., p. 495.

Phœnix sylvestris, *Roxb.*, *Rheede, Hort. Mal. iii.*, *tt.* 22 to 25, Kharjura (*Sans.*), Kajúr (*Hind.*, *Beng.*), Sendí (*Mar.*), Ishan-chedi (*Tam.*), also yields a juice, from which spirit is obtained. The fruit called *Khárik* pounded and mixed with almonds, Quince seeds, Pistachio nuts, spices and sugar forms a *Paushtik*, or restorative remedy much in vogue. A paste formed of the seeds and the root of *Achyranthes aspera* is eaten with betel leaves as a remedy for ague.

The juice of this palm is obtained by tapping the trunk.

LODOICEA SEYCHELLARUM, *Labill.*

Fig.—*Bot. Mag.*, 2734-5-6-7-8. Sea Cocoanut (*Eng.*), Coco-de-mer (*Fr.*).

Hab.—Seychelles.

Vernacular.—Darya-ka-náriyal (*Hind.*), Kadat-rengay (*Tam.*), Samudrapu-tenkaya (*Tel.*), Katal-tenna (*Mal.*), Darya-nu-náriyal (*Guz.*), Jahari-náral (*Mar.*).

History, Uses, &c.—Prior to the discovery of the Seychelles Islands in 1743, the large and peculiar-shaped nut of this palm, found floating in the Indian Ocean, was an object of curiosity which gave rise to many fabulous tales; it was called Sea Cocoanut and Coco-de-mer by Europeans, Narjíl-bahrí by the Arabs, Narjíl-i-daryaí by the Persians, and important medicinal virtues were attributed to it. It is now no longer valued by Europeans, but is still in great repute among the Arabs and Indians as a tonic, preservative, and alexipharmic.

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Rumphius gives a long account of this palm under the name of *Cocos Maldivicus*. The kernel is used in India in conjunction with *lignum colubrinum* as a tonic, and a paste made of it in conjunction with the powdered horns of the Sambhar deer and the seeds of *Strychnos Nux-vomica* is applied to enlarged glands.

Description.—Thomas Moore, in the *Treasury of Botany*, says: "This magnificent palm, which is found only in two small islands, Praslin and Curieuse, belonging to the Seychelles group, requires a great length of time to arrive at maturity. The shortest period before it puts forth its flower-buds is thirty years, and a hundred years elapse before it attains its full growth. From the age of 15 to 25 years it is in its greatest beauty, the leaves at this period being much longer than they are subsequently. The stem grows quite upright, straight as an iron pillar, and in the male trees frequently attains a hundred feet in height, the females being shorter. At the age of thirty, it first puts forth its blossoms, the males forming enormous catkins about three feet in length and three inches in diameter, while the females are set upon a strong zigzag stalk, from which hang four or five, or sometimes as many as eleven nuts, averaging about 40 lbs. weight each. From the time of flowering to the maturation of the fruit, a period of nearly ten years elapses, the full size, however, being attained in about four years, at which time it is soft and full of a semi-transparent jelly-like substance. The apparently peculiar formation of the root portion of this tree attracted much attention a few years since, but upon comparison with other palms it seems to be explained as an extraordinary development of a common system. The base of the stem is rounded and fits into a natural bowl or socket, which is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never, however, becoming attached to the bowl, their partial elasticity affording an almost imperceptible but very necessary 'play' to the parent stem when struggling against the force of violent gales. This

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bowl is of the same substance as the shell of the nut, only much thicker; it rots very slowly, for it has been found quite perfect and entire in every respect sixty years after the tree has been cut down." The fruits are covered externally with a thick fibrous husk, and contain usually one, but sometimes two or even three immense nuts with hard thick black shells, each being divided half-way down into two lobes. The kernel is from three-quarters to one inch thick, and very hard and white, having much the consistence of vegetable ivory: it has no odour or taste; when soaked in water it softens a little, and can be split into thin fibrous bundles.

Microscopic structure.—The kernel is composed of spindle-shaped cells having a central cavity, from which club-shaped canals extend to the cell-wall, where they are opposed to similar canals belonging to a neighbouring cell.

Commerce.—The nuts are an article of export from the Seychelles; hundreds of them may be seen at Port Victoria, Mahé, whither they are brought from the island of Praslin. Value in Bombay, Re. 1¼ per lb. for the dry kernel.

Entire nuts fetch from Re. 1 to Rs. 2 each, according to their size.

ARECA CATECHU, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 75; *Bentl. and. Trim., t.* 276. Areca palm (*Eng.*), Arec cultivé (*Fr.*).

Hab.—Cochin-China, Malay Peninsula and Islands. Cultivated throughout tropical India. The seed.

Vernacular.—Supári (*Hind., Beng., Guz., Mar.*), Kamugu, Pákku (*Tam.*), Póka-vakka, Vakka (*Tel.*), Adike (*Can.*), Adaka (*Mal.*).

History, Uses, &c.—The betel-nut, in Sanskrit Guváka, Puga, and Kramuka, is a masticatory of great antiquity in the East. In the *Panchadandachattraprabandha*, Devadamani, "she who compels the gods," goes to the court of king Vīkramáditya to play with him, dressed in a sky-blue robe, having in her

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hand and in her mouth a betel-nut wrapped in a leaf of the *kalpa*, one of the trees of Indra's paradise, a fabulous tree, granting all desires. The betel-nut is symbolical of festivity, and is a phallic emblem. Vincenzo Maria da Santa Caterina in his Viaggio alle Indie Orientale says:—"The Hindus adorn their idols with the nuts; if a woman wears them in her hair or on her neck it is a sign that she is public." The nuts are distributed along with sugar cakes at marriages (see cocoa-nut); when wrapped in the leaves of the *Piper Betle* or *pán*, along with lime and spices, they form the *bira* or *vira*, which is so much used by the natives of all parts of India, and is commonly presented by one to another in token of civility or affection. They are also given in confirmation of a pledge, promise, or betrothal, and among the Rajpoots are sometimes exchanged as a challenge: thus the expression *bira uthána* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dálna*, "to propose a premium," for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "*Vetalapanchavinshati*," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree nourishing himself with smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pán ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not an easy matter. The nut is also a constant offering to the gods at Hindoo temples, and on grand occasions the *bira* is covered with gold or silver leaf.

The betel-nut is mentioned in Chinese works written before the Christian era under the name of *Pin-lang*, by some supposed to be a corruption of the Malay name *Pinang;* but

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Bretschneider states (*Chinese Recorder*, 1871), on the authority of the *Nang Fang Tsao mu chang*, a work written in the 4th century, that the word is derived from Pin "a guest," in allusion to the custom of presenting the nuts to guests which had been introduced into China from India.

Early Arabian writers mention the Fúfal as the fruit of a certain palm, not of Arabia, hard as though it were wood. Their physicians describe it as good for hot and gross humors prepared as a liniment; and for inflammation of the eyes as a collyrium; and of great efficacy for drying up the seminal fluid, and as a digestive. Fúfal is a corruption of the Persian Púpal, a word probably cognate with the Sanskrit Kuvara "astringent," but said by some to be derived from the Hindi Kubar (कुबर) "humpbacked."

Though the betel-nut must have been known to the Greeks who visited India, it does not appear to have been noticed by any of their historians or medical writers; Desfontaines, however, suggests that it may have been the *Hestiatoris* or *Protomedia* of Pliny (24, 102), so called from its promotion of gaiety and good fellowship at carousals.

Hindu medical writers describe the unripe nuts as laxative and carminative, the fresh nuts as intoxicating and productive of giddiness; when dried, they are said to sweeten the breath, strengthen the gums, remove bad tastes from the mouth, and produce a stimulant or exhilarant effect on the system. Their use is recommended in urinary disorders and as an aphrodisiac; for the latter purpose a confection is made by boiling the nuts in milk and adding a number of aromatic and stimulant substances; sometimes Datura seeds and the leaves of *Cannabis indica* are added to this confection, when it is called *Kamesvara modaka.* Unripe betel-nuts which have been boiled are known as red betel, or *chikní suparí*, and an extract which is obtained from the water in which they have been boiled is often given to women along with powdered red betel and other spices after confinement as a gentle stimulant. In Western India this preparation is known as *supári che phúl.* The fact that the use of fresh betel-nuts gives rise to a sensation of strangling and

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giddiness is well known in the East, and it has also been observed that the nuts of certain trees in most betel plantations retain their poisonous properties when dried. These trees cannot be distinguished from the others, so that not unfrequently accidents happen from their nuts becoming mixed with the produce of the plantation before their presence has been detected. The poisonous properties are destroyed by heat, and consequently many people only use the cooked or red betel-nuts of commerce to avoid the possibility of accident. The only account of these poisonous nuts in European works appears to be that of Rumphius, which agrees in every respect with the particulars related by betel farmers whom we have questioned upon this subject; it is as follows:—"Plurimæ etiam recentes sunt nuces, quæ qualitatem hanc habent, quod manducantes inebrient, ac vertiginosos reddunt uti Tabacum illos afficit, qui ipsi not sunt adsueti; idem quoque, præstant vetustiores *Pinangæ* nuces, quæ novitianos adeo pectore oppressos, et auxios reddunt, ut strangulari videantur. Quæ proprie *Pinanga-mabok* seu *Pinanga inebrians* vocatur, atque hæ plurimum in tertia, seu nigra specie inveniuntur, (quæ a quibusdam pro diversa habentur specie) atque hæ dignoscuntur, si recentes transcissæ in media cavitate rubentes sint. Observavi vero neutiquam diversam hanc esse speciem, sed varietatem atque degenerationem duarum memoratarum specierum, quæ hinc inde in arboribus reperiuntur, quamvis etiam arbores occurant, quarum cunctæ nuces hanc habent malignitatem, ac præsertim tertiæ speciei." Rumphius adds that when these nuts have been eaten by mistake, salt or limejuice, or acid pickles are the best remedies. The above facts seem to indicate the return of a few plants to an original wild form now extinct, especially as the fresh nuts of the best trees produce similar effects in a less degree.

In Europe betel-nuts have been used as an anthelmintic for tape-worm and as an astringent, and in veterinary practice their reputation as a vermifuge is well established.

Up to 1889 it was not known to which of its constituents the areca nut owed its extensive use in the East as a masticatory

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Bombelon (*Pharm Journ.* [3], xvi., 838) was the first to announce that it contained a liquid volatile alkaloid, the properties and composition of which, however, he did not describe. As it seemed probable that the physiologically active constituent was to be looked for in this alkaloid, Herr Jahns was induced to investigate the subject more closely (*Berichte*, xxi., 3404). From his investigation it is clear that an alkaloid *arecoline* is the most active constituent of the nut. Its physiological action has been studied by Dr. Maumé of Göttingen (*Pharm. Zeit.*, Feb. 9, 1889, p. 97), who used for this purpose the hydrobromide and the hydrochloride, of which subcutaneous or intravenous injections were made, or sometimes the solution was applied to the conjunctiva. It was found that full-grown rabbits died within a few minutes after the subcutaneous injection of 25 to 50 milligrams, but recovered after 10 milligrams. Cats succumbed after the administration similarly of 10 to 20 milligrams, only the course of the poisoning was somewhat more prolonged. Dogs, even small animals of 5 to 6 kilograms body-weight, although strongly poisoned by the subcutaneous injection of 50 to 55 milligrams, were not always killed.

The symptoms of poisoning which were observed corresponded in many respects with those seen by Schmiedeberg in his investigation of muscarine, and further, when lethal doses were not used, they could be neutralized by means of atropine sulphate; eventually, however, they presented characteristic differences. The most dangerous action of arecoline consists in the slowing of the heart's action by small doses, or even its stoppage, just as takes place with muscarine; but the latter works in smaller doses, and it is only after somewhat larger doses of arecoline that the ventricle of the frog stops in diastole, or is so influenced that it is not emptied, and only after long intervals makes a weak undulatory muscular contraction. Subsequent injection of atropine removes this action upon the heart. Simultaneously with the heart's action the respiration is also affected. Small doses cause a considerable increase in the number of inspirations; larger doses cause a slower action

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with intensified expiration; and very large doses rapidly stop the breathing, especially in cats. After introvenous injection of a lethal dose the respiration usually ceases before the action of the heart.

The subcutaneous injection of 50 to 70 milligrams of arecoline salts into dogs of 4 to 5 kilograms body-weight, besides strong irritation of the heart, gives rise to tetanic cramps, which quickly give place to a partial paralysis.

As a rule, however, the animals overcome the effects of such doses, the heart resuming its action completely as the effects pass off, but it becomes again affected through vomiting and liquid evacuations in which sometimes also worms are brought away. An increased peristaltic action of the bowels is, however, provoked in rabbits, dogs, and cats by much smaller doses.

Intense poisoning of dogs, rabbits, and cats with arecoline may also be accompanied with so strong a contraction of the pupils of both eyes, that in dogs and rabbits they do not show larger than the head of a good-sized pin, whilst in cats they are reduced to a mere streak. Instillation of arecoline solution in an eye gives rise also to a strong one-sided narrowing of the pupil, but the quantity required is so large that the production of myosis in one eye may induce a flow of saliva in rabbits, and affect the heart and respiration in cats. For this reason the action of arecoline upon the human iris has not yet been tested.

It is in accord with observations made during the experiments on animals that the organism may become gradually tolerant to the poison of areca nut, as in the case of tobacco. In the opinion of Dr. Maumé, the physiological experiments indicate that the nut may prove a valuable article of the Materia Medica, since there can be no doubt that arecoline hydrobromide is capable of being utilized therapeutically on account of its effect on the peristaltic action of the bowels and also in suitable combination as a cardiac remedy. Of the other alkaloids which have been separated from areca nut, *choline*

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is a natural constituent of the brain-substance, and *arecaine* comes near to the trigonelline of fœnugreek. (*Pharm. Journ.*, Feb. 23, 1889.)

Description—The betel-nut has the shape of a very short, rounded cone, scarcely an inch in height; it is depressed at the centre of the base. The testa, which seems to be partially adherent to the endocarp, is obscurely defined, and inseparable from the nucleus. Its surface is marked with a network of veins, running chiefly from the hilum; these veins extend into the white albumen, giving the seed a strong resemblance to a nutmeg. The small conical embryo is situated at the base. The ripe nut is feebly astringent. Caustic lye turns the brown portion red.

Chemical composition.—The nut contains about 15 per cent. of tannin substance, and 14 per cent. of fat, colouring matter, &c. (*Pharmacographia.*) In the preparation of the bases Herr Jahns adopted two methods, which gave equally good results. According to one, the powdered seeds were exhausted three times with cold water, to which strong sulphuric acid had been added in the proportion of two grams to each kilogram of the seeds; the pressed and filtered extracts were evaporated to about the weight of the raw material used, and after cooling and again filtering precipitated with potassium-bismuth iodide and sulphuric acid. An excess of the precipitant had to be avoided, since it exercises a solvent action on the separated double salt. The red crystalline precipitate was after some days filtered out, washed and decomposed by boiling with barium carbonate and water; the alkaloids went completely into solution, whilst bismuth oxyiodide, colouring matter, &c., remained undissolved. After filtration the alkaloidal solution was evaporated to a small volume, treated with sufficient caustic baryta, and shaken repeatedly with ether, which removed a base that has been named "arecoline," on account of its oil-like character. The residual liquid, which, beside alkaloidal hydriodides, contained some barium iodide, was neutralized with sulphuric acid, and the alkaloids were set free by treatment successively with

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silver sulphate, caustic baryta and carbonic acid. The solution of the pure alkaloids was evaporated to dryness and the residue exhausted with cold absolute alcohol (or chloroform). "Arecaine" remained undissolved, whilst a third alkaloid, together with colouring matter, &c., went into solution, and upon evaporation of the alcohol remained as an amorphous mass.

According to the second method, the powdered areca nuts were exhausted cold with milk of lime, the filtered extracts neutralized with sulphuric acid and evaporated to a syrupy consistence. By dissolving in a little water and filtering, the gypsum and separated colouring matter were removed; the solution was then again concentrated, made alkaline, and the arecoline shaken out with ether. The other bases were then precipitated as before with potassium-bismuth iodide and sulphuric acid.

The yield of arecoline amounted to 0·07, or at most 0·1 per cent., that of arecaine to 0·1 per cent., and that of arecaidine to 0·1 per cent.

Arecoline, $C^8H^{13}NO^2$, was withdrawn from the ether solution obtained as described by shaking it with acidulated water, the neutralized liquid evaporated to a small volume, and after adding sufficient potash solution again shaken out with ether. The base left upon evaporation of this solution was neutralized with hydrobromic acid, and the dried salt perfectly purified by repeated recrystallization from absolute alcohol. From this purified compound the free base and other salts of it are prepared.

Arecoline forms a colourless oily liquid of strongly alkaline reaction, which is soluble in all proportions in water, alcohol, ether, and chloroform. It is volatile and can be distilled, the boiling point being 209°C. The salts are easily soluble, some of them deliquescent, but mostly crystallizable. It gives with potassium-bismuth iodide a pomegranate-red precipitate, consisting of microscopic crystals (a delicate reaction), and with phosphomolybdic acid a white precipitate. Potassium-mercury iodide throws down from solutions not too dilute yellow oily drops, which after several days solidify and crystallize; solution

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of iodine throws down brown drops, and picric acid a resinous precipitate that afterwards crystallizes in needles. Gold chloride also throws down oily drops, which, however, do not solidify. Platinic chloride, mercuric chloride, and tannic acid give no precipitates.

Arecaine ($C^7H^{11}NO^2 \cdot H^2O$), purified by repeated crystallizations from 60 per cent. alcohol, forms colourless crystals, permanent in the air, freely soluble in water and in dilute alcohol, less soluble in stronger and nearly insoluble in absolute alcohol, by which it is dehydrated. It is also insoluble in ether, chloroform, and benzol. The aqueous solution is neutral in reaction, and has a slightly perceptible weak saline taste. At 100°C. arecaine loses its water of crystallization, melts with frothing at 213°C., and carbonizes when more strongly heated. In a solution acidulated with sulphuric acid potassium-bismuth iodide produces an amorphous red precipitate that very quickly becomes crystalline. Potassium-mercury iodide is far less delicate; it does not precipitate the (neutral) solution of the free alkaloid, but if this be acidified the double salt separates in yellow needles, or at first as an oily precipitate that quickly crystallizes. Potassium iodide also fails to affect a neutral solution, but upon acid being added dark-coloured needles separate. Phosphomolybdic acid, as well as tannic acid, give a slight turbidity; picric acid gives no precipitate, and gold chloride and platinic chloride precipitate crystalline double salts from solutions that are not too dilute.

Arecaine combines with acids to form crystalline salts, having an acid reaction, freely soluble in water and less soluble in alcohol.

Arecaidine, $C^7H^{11}NO^2H^2O$, isomeric with arecaine, forms colourless, permanent, tabular crystals, and is easily soluble in water and dilute alcohol, but almost insoluble in absolute alcohol, ether, chloroform, and benzol; it loses its water of crystallization at 100°C., and melts, attended with frothing, at 222-223°C.; it forms crystallizable salts and is precipitated by platinic and auric chlorides. Arecaine and arecaidine are

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easily separated by treatment with methyl-alcohol and hydrochloric acid, whereby arecaidine is converted into its methyl ester, arecoline, and arecaine into the hydrochloride.

Herr Jahns (*Berichte*, xxiv., 2615) describes a fourth crystalline alkaloid in areca nuts, to which he gives the name *Guvacine*, from *guváka*, a Sanskrit name for the areca palm. Guvacine is less soluble in water or dilute alcohol than the other alkaloids, crystallizes in small shining crystals that darken at 265°C. and melt at 271-272° with decomposition. The crystals contain no water of crystallization, and upon analysis yield results corresponding to the formula $C^6H^9NO^2$. Of the salts, the hydrochloride, sulphate, nitrate, platinochloride $(C^6H^9NO^2 \cdot HCl)^2 \cdot PtCl^4 + 4H^2O$, and auro-chloride, $C^6H^9NO^2 \cdot HCl \cdot AuCl^3$, have been prepared and crystallize well. It therefore appears that a series of bases occur in the areca nut, which, with the exception of choline, stand in near relation to each other—

Choline $C^5H^{13}NO^2$ Arecaine $C^7H^{11}NO^2 + H^2O$
Guvacine $C^6H^9NO^2$ Arecaidine $C^7H^{11}NO^2 + H^2O$
Arecoline $C^8H^{13}NO^2$

Probably other members of the series may be found by examination of a larger quantity of material. (*Pharm. Ztg.*, 1891, 516; *Pharm. Journ.*, Oct. 3, 1891.)

Toxicology.—Cases of poisoning from eating fresh betel-nuts or the poisonous nuts by mistake, not unfrequently occur, but we have not heard of any fatal termination after such accidents. The remedies used are acid pickles and copious draughts of cold water. The sufferers complain of great oppression in the chest, with a sense of faintness and suffocation, sometimes followed by vomiting. According to Maumé, arecoline separates unaltered with the secretions and excretions, from which it can be recovered. In the absence of a characteristic colour reaction, arecoline separated from urine can only be identified chemically by its behaviour with potassium-bismuth iodide, and physiologically by its action upon the heart of a curarized frog.

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Commerce.—Some idea of the consumption of betel-nut in India may be formed from the fact, that in addition to her own produce India imports about 30,500,000 pounds of the nut, value about 34 lakhs of rupees, from Ceylon, the Straits Settlements, and Sumatra. The exports are under 500,000 lbs. which go to Eastern countries frequented by Indians, such as Zanzibar, Mauritius, Aden, China, &c. Bombay is the chief centre of the export trade.

The coasting trade statistics show a total of about 44,000,000 lbs., value about 55½ lakhs of rupees, passing from port to port. Bengal, Madras, and Goa are the chief producing provinces. The exports by land beyond the frontier are very trifling, about 1,000,000 lbs. going to Nepal and Bhutan.

The varieties of the nut met with in trade are numerous; they may be classed as natural and artificial: the first class includes the different varieties of ripe betel-nut produced by cultivation which have not undergone any preparation; the second class, all nuts, ripe or unripe, which have been treated by boiling or other processes before being offered for sale.

CALAMUS DRACO, *Willd.*

Fig.—*Blume in Rumphia, ii., tt.* 131-132.

Hab.—Indian Archipelago. The resin (Dragon's blood).

Vernacular.—It is known by the same names as the gum of *Dracæna Cinnabari* (p. 504).

History, Uses, &c.—The original Dragon's blood of commerce was not derived from this plant. The older writers upon Eastern commerce speak of Dragon's blood as an export to the East from Arabia and Socotra. Ibn Batuta, who visited Java and Sumatra between 1325 and 1349, makes no mention of this substance among the products of those islands. Barbosa, writing in 1514, speaks of Dragon's blood as a product of Socotra, but makes no mention of it amongst drugs found in Malacca, Java, Sumatra, or Borneo. (*Pharmacographia.*) Rumphius is the first who describes the mode of preparation followed

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at Palembang to procure this drug. It appears that the resin exudes in abundance from the fruit, and, being very brittle, is easily detached by shaking and friction; finally it is exposed to a heat sufficient to make it form a uniform mass. An inferior quality is said to be extracted from the crushed fruit by boiling.

This drug is not mentioned by Indian writers on Materia Medica, but it is now frequently supplied by native druggists, and their customers probably do not distinguish it from the genuine article.

Description.—Lump Dragon's blood only is imported into Bombay from the East: it occurs in large blocks of irregular form; it differs from Socotra Dragon's blood in containing remains of the fruit and numerous scales. Its fracture is somewhat porous, but in good samples the colour is nearly as brilliant as that of the drops from Socotra.

Chemical composition.—A very complete investigation of the properties of the various kinds of Dragon's blood has been made by Messrs. Dobbie and Henderson. (*Pharm. Journ.*, Nov. 10th, 1883.) They say: "Our results may be summed up as follows:—There are at least four distinct kinds of red resin presently sold as Dragon's blood, or labelled in collections under that name. One variety is brick-red in colour, melts at about 80°C., gives off red-coloured highly irritating fumes when decomposed by heat, dissolves readily with an orange-red colour in alcohol, ether, chloroform, carbon bisulphide and benzene, is insoluble or only slightly soluble in cold caustic soda, ammonia, lime water and sodium carbonate, and dissolves with difficulty when boiled in these reagents. Its alcoholic solution has an acid reaction and gives a brown-red coloured precipitate when mixed with a solution of lead acetate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is undoubtedly the resin of *Calamus Draco*, some of the specimens which were examined having their origin well authenticated.

"A second variety is of a beautiful carmine-red colour, melts about 100° C., gives off non-irritating fumes when decomposed

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by heat, dissolves freely with a pink colour in alcohol, ether and chloroform, but is insoluble in carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia and sodium carbonate, and much more readily than the foregoing in lime water. Its alcoholic solution has an acid reaction and gives a lilac-coloured precipitate with lead acetate. Its composition may be represented by the formula $C^{17}H^{19}O^{5}$. The source of this resin is quite uncertain. We have no means of determining whether it is identical with any hitherto described variety of red resin. The specimens examined are marked as having come from the Dutch East Indies, but beyond this we know nothing of their origin.

"A third variety is of a vermilion colour, melts about 80°C., gives off aromatic irritating fumes when decomposed by heat, dissolves with a blood-red colour in alcohol and ether, but is insoluble in chloroform, carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia, lime water and sodium carbonate. Its alcoholic solution has an acid reaction and gives with lead acetate a mauve-coloured precipitate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is the resin from a species of *Dracæna*. One of the specimens examined is from *Dracæna Cinnabari*, Socotra, and as it was gathered by Professor Balfour there can be no doubt as to its origin. Another specimen is from *Dracæna Draco*, and its origin is also well authenticated. The other specimens examined are marked some of them *Calamus*, but there can be little doubt that this is a mistake, and that all the resins having the properties just enumerated are derived from species of *Dracæna*. It seems certain then that the resin derived from *Dracæna* is totally different in property from that derived from *Calamus*.

"The fourth variety is a mixture, in varying proportions, of a reddish-brown coloured resin, freely soluble in carbon bisulphide, and a light brick-red coloured resin, nearly insoluble in carbon bisulphide. The two portions also differ considerably as regards their solubility in ether, benzene, and other reagents, the dark portion being in all cases the less soluble of

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the two. Since, however, it dissolves to a slight extent in all reagents, we found it impossible to effect a complete separation of the two portions. The portion freely soluble in carbon bisulphide is probably identical with the resins of our first class, while the other portion seems to be a distinct resin.

"Much discussion has taken place with regard to the presence of a volatile acid in Dragon's blood. It seems certain that none of the varieties of this resin contain benzoic acid; at all events we failed to obtain an extract from any of them with petroleum ether, in which benzoic acid is freely soluble. We tested for cinnamic acid by sublimation, and found it present in the resins of the first and third classes, but not in those of the second and fourth classes. To ascertain the delicacy of this method we made a preliminary experiment with artificial mixtures containing 1 per cent. of cinnamic acid, and found that the acid could be separated out by sublimation from very small quantities of such a mixture. Probably the error as to the presence of benzoic acid arose through confounding it with cinnamic acid, or possibly from working with a resin in which benzoic acid had been formed by partial oxidation."

PANDANACEÆ.

PANDANUS ODORATISSIMUS, *Linn. f.*

Fig.—*Roxb. Cor. Pl. i., tt.* 94—96. Screw Pine, Kaldera bush (*Eng.*), Pandan odoriferante (*Fr.*).

Hab.—India, Persia, Arabia. The stems, male inflorescence and seeds.

Vernacular.—Keora (*Hind.*), Keya (*Beng.*), Kevada (*Mar.*), Kevado (*Guz.*), Tázhan-chedi (*Tam.*), Mogali-chettu, Gájangi (*Tel.*), Tázha, Kaita (*Mal.*), Tále-mara, Kyádage-gida (*Can.*).

History, Uses, &c.—The Ketaka or Dhúli-pushpika "dust flower," whose golden spikes of flowers are said to atone

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for all its defects, is a great favourite with Vishnu and Krishna, and its flower-leaves are much worn by women in their hair. The poets also celebrate its perfume. In the play of Malati and Madhava, the latter says:—

> The slowly rising breezes spread around
> The grateful fragrance of the Ketaka.

A strophe quoted by Böhtlingk (*Indische Sprüche*, i., 2083) says:—The drunken bee mistakes the golden flowers of the Ketaka for a lotus, and blinded by desire rushes into the flower and leaves his wings behind him. In the Gita Govinda, the bracts are likened to a lance fit to pierce the hearts of lovers, and the opening buds of the Jasmine are supposed to be impregnated by its pollen.

The defects of this plant are described as its crookedness, abundance of thorns (suchi-pushpa), and the desert places which it selects for a habitation. The Ketaka is obnoxious to Siva, and the following story is told to account for his hatred of the tree: Gambling with Parvati he is said to have lost everything he possessed, even to down the clothes upon his back. In a fit of repentance he wandered away and was lost to his friends, who afterwards discovered that he had retired into a forest of Ketaka trees and had become an ascetic. Parvati, having assumed the form of a Bhil damsel with Ketaka in her hair, followed him into the forest, and having succeeded in making him break his vow afterwards upbraided him for inconstancy; whereupon he cursed the Ketaka and any one who should offer its flowers at his shrine. This episode is the subject of a well-known Marathi *laoni*:—

> Siva sáthi jhali bhilina
> Jaga mohini Girja jhali udása.

> Unhappy Girje, erst the world's ador'd
> A gipsy maid now, seeks for Shiv her lord.

According to the Nighantás, the plant has bitter, sweet, light, and pungent properties, and removes phlegmatic humors.

In Persia it is called Kádi, Gulkiri, and Gul-i-kabadi; the Arabs call it Kádi and Kadar. Rázi recommends it in leprosy

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and small-pox; it is considered by Mahometan physicians to be cardiacal, cephalic, and aphrodisiacal. They prepare a *sharab* by boiling the pounded stems in water, also a distilled water from the flowering tops and a perfumed oil. Mir Muhammad Husain states that the Hindus believe that if these preparations are used when small-pox is prevalent, the disease will be averted, or be of so mild a form as to be free from danger. The ashes of the wood are said to promote the healing of wounds, and the seeds to strengthen the heart and liver.

In India the perfumed oil is prepared by placing the floral bracts in sesamum oil and exposing it to the sun for forty days; fresh bracts are supplied and the old ones removed several times during this period. This oil is much valued as a perfume, and is used as a remedy for earache and suppuration of the meatus. The distilled water may be simple or compound; in the latter case the bracts are distilled with rose-water or sandalwood chips; it is used as a perfume and to flavour sherbets.

The leaves of several species of Pandanus are used for making mats and to polish lacquer-ware, and the fruit has been eaten in famine times. The edible species (*P. edulis, Thonars*), common in Madagascar and the islands of the South Pacific, does not occur in India. The aerial roots of the different species are much used to make coarse brushes in the East, a portion of the desired length being cut and the end beaten until the fibres separate.

Description.—The male inflorescence is a large, terminal, pendulous, compound, leafy panicle, the leaves of which are yellowish-white, linear-oblong, pointed and concave, the margins being armed with very fine sharp spines; in the axil of each there is a single thyrse, composed of simple, small racemes of long, pointed, depending anthers, which are not sessile, but raised from the rachis of these partial racemes by tapering filaments. The fruit is compound, oval, from six to eight inches in diamater, and from six to ten long, weighing from four to eight pounds, rough, of a rich orange colour, composed

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of numerous, wedge-shaped, angular drupes; when ripe their large or exterior ends are detached from one another, and covered with a firm, orange-coloured skin; apices flat, consisting of as many angular, somewhat convex tubercles as there are cells in the drupe, each crowned with the withered stigma, internally the exterior half of these drupes next the apex consists of dry spongy cavities, their lower part, next the core or common receptacle, is yellow, consisting of a rich-looking, yellow pulp, intermixed with strong fibres; here the nut is lodged. Nut of each drupe compound, turbinate, exceedingly hard, angular, containing as many cells as there are divisions in the apex of the drupe; each cell is perforated above and below. Seeds single, oblong, smooth, adhering lengthwise to a small fasicle of strong white fibres, which pass through the perforations of the cell. (*Roxburgh.*)

TYPHACEÆ.

Typha angustifolia, *Linn., Eng. Bot.* 1456. *Vern.*—Rámabána. The soft woolly inflorescence of the male spadix is applied like cotton to wounds and ulcers. The plant is abundant on the banks of the Indus, where it is called "Pun." From the pollen is made the Búr or Búratú, much eaten by the natives of Sind. The Sanskrit name is Eraka.

Description.—Perennial, culms straight, 6 to 10 feet high, round, smooth, jointed at the insertion of the leaves; leaves long, ensiform, obtuse, flat on the inside, as long or nearly as long as the stem, about 3 to 4 inches broad; sheath smooth, embracing the culms; male catkin 2 to 3 inches above the female, cylindric, 8 to 10 inches long, densely covered with stamens, and numerous 3 to 4 cleft fine filaments, each with 2 to 3 anthers; anthers linear; female catkin 8 to 10 inches long; glume with fine filaments.

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AROIDEÆ.

ACORUS CALAMUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 279; *Rheede, Hort. Mal. xi.*, *t.* 48. Sweet-Flag (*Eng.*), Acore vrai (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The rhizome.

Vernacular.—Bach, Gora-bach (*Hind.*, *Beng.*), Vekhand, Gora-bach (*Guz.*), Vekhand, Bál-vekhand (*Mar.*), Vashambu (*Tam.*), Vasa (*Tel.*), Vashanpa (*Mal.*), Vajé (*Can.*).

History, Uses, &c.—This plant bears the Sanskrit names of Vachá "talking," Shadgrantha "six-knotted," Ugragandha "strong smelling," Jatilá "having entangled hair," &c., and is described in the Nighantás as hot, pungent, bitter, stomachic and emetic; useful for clearing the voice by removing phlegm, and in colic. As an emetic it is administered in doses of about 80 grains with half a *sér* of tepid salt water; in dyspepsia it is given in combination with asafœtida, long pepper, black pepper, ginger, chebulic myrobalans, *sonchal* salt, and the tubers of *Aconitum heterophyllum*, of all equal parts, in doses of half a drachm. As a stimulant or nervine it is used in combination with other remedies in low fevers, epilepsy, and insanity. The authors of the *Pharmacographia* remark—"The descriptions of *Acoron*, a plant of Colchis, Galatia, Pontus, and Crete, given by Dioscorides and Pliny, certainly refer to this drug." The Arabian physicians also agree in identifying it with the *Acoron* of the Greeks, a name probably derived from the Persian *Agar*. Ibu Sina describes the drug under the name of Waj, and quotes Galen with regard to its properties, and all the Arabian and Persian physicians reproduce what Dioscorides has written concerning ακόρον. That this plant is not the *Calamus aromaticus* of the ancients appears to be evident, as Pliny describes both *Acoron* and *Calamus aromaticus*. The Arabians also do not identify the plant with *Calamus aromaticus*, but describe the latter under the name of Kasab-ed-darira and

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identify it with *Swertia Chirata.* Hájá Zein states that in his time (1368) Kasab-ed-darira came from Calicut, where it was called by the natives *Báringa;* if this statement is correct, the drug used by him must have been either *Premna herbacea* or *Clerodendron serratum,* the Bháringa of the Hindus. Royle supposes *Calamus aromaticus* to have been an Andropogon. Mahometan writers describe it as deobstruent and depurative, useful for the expulsion of the phlegmatic humours, which they suppose to be the cause of paralysis, dropsy, and many other diseases; they recommend it to be given to children to bite when teething, and prescribe it internally in calculous affections. It has also a reputation as a diuretic, emmenagogue, and aphrodisiac, and is applied in the form of poultice to paralysed limbs and rheumatic swellings. A pessary composed of Acorus, saffron, and mare's milk is used to promote delivery; a hip bath of the decoction is also said to be efficient for this purpose. Dr. Ondaatji, Colonial Surgeon of Ceylon, has brought to notice the use of sweet-flag as an anthelmintic in that island. He says: "An infusion of the rhizome given to young children acts effectually, as I have seen many such cases treated among the natives." Dr. Evers at the Seoni Main Dispensary has found the drug very effectual in dysentery. He uses the following decoction:—Bruised rhizome 2 ozs., Coriander 1 dr., Black pepper ½ dr., Water one pint. Boil down to 12 ounces, and let cool. Dose for an adult 1 ounce three times a day; for a child 1 to 3 drachms, sweetened with sugar, two or three times a day. He also remarks:—"The decoction is not only useful in dysentery and diarrhœa, but also in the bronchitic affections of children." I have often taken it myself when suffering from a bad cold in the chest. (*Ind. Med. Gazette,* Feb. 1875.)

The evidence collected by Dr. Watt for *Dict. Econ. Prod. of India* testifies to the value of Acorus as an aromatic bitter and stimulant, especially useful in allaying distressing cough.

Description.—The root-stock occurs in somewhat tortuous, sub-cylindrical or flattened pieces, of variable length; to

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the upper surface of these is attached the lower portion of the leaves which have been cut off; on the under surface may be seen a zigzag line of little elevated dot-like rings, the scars of roots. The root-stock is usually rough and shrunken, varying in colour from dark-brown to orange-brown, breaking easily with a short corky fracture, and exhibiting a whitish spongy interior. The odour is aromatic and agreeable; the taste bitterish and pungent. The Persian variety of Acorus is darker in colour when fractured and has a more powerful odour, the leaves have been entirely removed, instead of being cut off short.

Microscopic structure.—A section of the rhizome is like an open network composed of rows of nearly round cells and open spaces (water passages); most of the cells contain small starch granules, but some of them essential oil; at the junction of the cortical and central portions of the rhizome is a very distinct row of small empty cells. The vascular bundles are numerous, especially just within the line of small cells just noticed; each bundle consists of a ring of spiral vessels surrounding a number of jointed tubes.

Chemical composition.—The authors of *Pharmacographia* say:—" The dried rhizome yielded us 1·3 per cent. of a yellowish neutral essential oil of agreeable odour, which in a column of 50 mm. long deviates the ray of polarized light 13·8° to the right. By working on a large scale, Messrs. Schimmel & Co., of Leipzig, obtained 2·4 to 2·6 per cent. According to Kurbatow (1873), this oil contains a hydrocarbon, $C^{10}H^{16}$, boiling at 159° C., and forming a crystalline compound with HCl, and another hydrocarbon boiling at 255—258° C., affording no crystallizable hydrochloric compound. By submitting the oil to fractional distillation, we noticed, above 250°, a blue portion, which may be decolourized by sodium. The crude oil acquires a dark-brownish colour on addition of perchloride of iron, but is not at all soluble in concentrated potash solution.

The bitter principle, *Acorin*, was isolated by Faust in 1867, as a semi-fluid, brownish glucoside, containing nitrogen, soluble

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both in ether and in alcohol, but neither in benzol nor in water. In order to obtain this substance, we precipitated the decoction of 10 lbs. of the drug by means of tannic acid, and followed the method commonly practised in the preparation of bitter principles. By finally exhausting the residue with chloroform, we succeeded in obtaining a very bitter, perfectly crystalline body, but in so minute a quantity that we were unable to investigate its nature." (*Op. cit.*, 2nd Ed., p. 678.)

Herr Thoms (*Archiv. der Pharm.* [3] xxiv., p. 465) announced the absence of nitrogen in acorin, which is contrary to the results obtained by Faust; at the same time this author states that under the influence of acids and alkalies, or of emulsin, acorin splits up into sugar and carburet of hydrogen, and that it readily oxidizes and is converted into a resinous substance *acoretin*, which, when reduced from alkaline solution by nascent hydrogen, gives an essential oil and sugar as final products.

The fact of a glucoside behaving in this way being inadmissible has led M. Geuther to make a fresh examination of acorin, which he obtained by exhausting the root with cold water and separating the acorin by means of animal charcoal; the impure acorin was then removed from the charcoal by means of alcohol, and, after purification, was found to contain 3·2 p. c. of nitrogen, 70·0 of carbon, and 9·1 of hydrogen. Treated with a boiling dilute solution of soda it yielded no sugar, but was converted into an acid substance which strongly reddened litmus; treatment with dilute acids also yielded no sugar. Exhausted by soda, the bitter matter has the formula $C^{80}H^{67}NO^{14}$, and the acid which has been yielded to the alkali has the formula $C^{22}H^{18}O^{6}$; treated with hydrochloric acid it sets free an acid of the formula $C^{22}H^{16}O^{8}$ or $C^{22}H^{15}O^{8}$, which appears to be a product of the oxidation of the free acid already noticed. M. Geuther considers that the acoretin of Herr Thoms is nothing but impure acorin. (*Annalen der Chem.*, ccxl., p. 92.)

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SCINDAPSUS OFFICINALIS, *Schott.*

Fig.—*Wight, Icon., t.* 781.

Hab.—Bengal. The fruit.

Vernacular.—Gaj-pipli, Bari-pipli (*Hind.*), Gaja-pipal (*Beng.*), Atti-tippili (*Tam., Mal.*), Enuga-pippallu (*Tel.*), Dodda-hipalli (*Can.*), Thora-pimpali (*Mar.*), Motho-pimpali (*Guz.*).

History, Uses, &c.—The ripe fruit of this plant is the true Gaja-pippali of the Nighantás; it also bears the Sanskrit names of Kari-pippali, Kapi-valli, Kota-valli, Shreyasi, and Vashira. It is described as aromatic, carminative, stimulant, and useful in diarrhœa, asthma, and other affections supposed to be caused by deranged phlegm. In practice it is generally used as an adjunct to other medicines. *S. officinalis* is cultivated in Bengal, chiefly in the Midnapore district, and the fruits, cut into transverse pieces and dried, form the Gaja-pipal of the druggists of Eastern and Southern India.

In Northern and Western India an entirely different drug is sold under the same name; it consists of the entire plant of a Balanophora often remaining attached to a small piece of the dead stick upon which it grew. The largest of these plants are about five inches in length, and consist of a kind of cellular cup, from which springs a scaly spadix surmounted by a glandular-shaped club of imperfect flowers, beneath which the stem is marked by little pits showing the places where the female flowers were attached. This drug is mucilaginous and astringent, and is no doubt improperly substituted for the genuine article.

Description.—The fruit of *S. officinalis* occurs in slices an inch or less in diameter and about ¼ inch in thickness, of a greyish colour and almost inodorous. The slices consist of a central core surrounded by the seeds partly enclosed in the dried pulp of the arils; when soaked in water they swell up and soften, and the core may be seen to contain numerous large liber cells very sharply pointed at both ends which act like stinging hairs. The pulp surrounding the seeds is full of needle-like crystals of oxalate of lime, similar to those found in the acrid

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corms of other aroids. The seeds are rather larger than hemp seeds, kidney-shaped, grey and polished; they contain a white oily kernel.

Chemical composition.—With the exception of a minute trace of an alkaloid, nothing of special interest was detected. The mucilage afforded jelly-like precipitates with plumbic acetate and ferric chloride. No tannin was present. Ash, 14·6 per cent.

Scindapsus pertusus, *Schott., Rheede, Hort. Mal. xii., tt.* 20, 21, is a large perennial plant, running over trees and rooting on them like Ivy; leaves alternate, resembling those of the Pipal (*Ficus religiosa*) but larger, often perforated and cut in the margins; spadices shortly-peduncled; spathe gibbous, acute, a little longer than the spadix; spadix cylindric-obtuse. The juice of the plant with black pepper is given to people who have been bitten by the *Kusriya Ghanas*,* a snake so called because the part bitten by it mortifies. The juice, with that of the roots of *Croton oblongifolium* and of the fruit of *Momordica Charantia*, is also applied to the bitten part.

ALOCASIA INDICA, *Schott.*

Fig.—*Wight Ic., t.* 794.

Hab.—India, cultivated in Bengal and elsewhere. The root-stock.

Vernacular.—Mánkand, Kachu (*Hind.*), Mán-kachu (*Beng.*), Kás-alu (*Mar.*).

History, Uses, &c.—This large Arum is the Mánaka of Sanskrit writers; its root-stock is a valuable and important article of diet in Bengal, and often grows to an immense size, being from six to eight feet in length, and as thick as a man's leg. When dried it can be kept for a considerable time and affords a large supply of starchy food. In Western India it is much cultivated as an ornamental plant in gardens, but is little known as an article of diet; the acrid juice of the petioles is, however, much used as a common domestic remedy

* Daboia Russellii, a viper.

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on account of its styptic and astringent properties. The petiole is slightly roasted and the juice expressed. We have seen purulent discharge from the ears in children stopped by a single application. The tubers chopped fine, tied in a cloth and heated, are used as a fomentation in rheumatism.

Medicinally *mánaka* is said to be useful in anasarca, in which disease it is used in the following manner. Take of the meal of the root-stock eight tolás, rice-meal sixteen tolás, water and milk forty-eight tolás each; boil them together till the water has evaporated. This preparation is called *Mána-manda*, and is given as an article of diet to the patient, nothing else being allowed during its administration except milk. (*Chakradatta.*)

As a vegetable, the root-stock is peeled, cut in small pieces and well boiled to remove its acridity; it is then mixed with other vegetables and cooked with the usual condiments. Dr. D. Basu (*Dict. Econ. Prod. Ind.*, i., 178) remarks—"I have never used it solely as a medicine; but as food taken frequently, it seems to act as a mild laxative and diuretic. In piles and habitual constipation it is useful." Surgeon-Major R. S. Dutt (*idem*) states that it is a very agreeable vegetable during convalescence of natives from bowel complaints; it is light and nutritious and somewhat mucilaginous. The ash of the root-stocks mixed with honey is a popular remedy for aphthæ.

Description.—The root-stock occurs in large round pieces, a foot or more in length, and covered externally by the brown dried remains of the leaf petioles and their sheaths. Internally it is white, opaque, and starchy, and when fresh has an acrid odour which is lost on drying. Pulped and washed it yields a large quantity of pure white starch.

Chemical composition.—The acridity of this plant has been shown by Pedler and Warden (*Jr., Asiatic Soc., Bengal*, Vol. LVII., Part II.) to be due to the large number of acicular crystals of oxalate of lime contained in its tissues.

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AMORPHOPHALLUS CAMPANULATUS,

Blume.

Fig.—*Roxb. Cor. Pl. iii., t.* 272; *Bot. Mag., t.* 2812; *Wight Ic.*, 785.

Hab.—India. Much cultivated. The tubers.

Vernacular.— Jimi-kand (*Hind.*), Ol (*Beng.*), Surana (*Mar., Guz.*), Suranu (*Can.*), Karunai-kizhangu (*Tam.*), Kanda-godda (*Tel.*), Karuna-kizhanna (*Mal.*).

History, Uses, &c.—This arum occurs as a wild plant on the banks of streams and also in several cultivated forms. It is the Surana and Olla of Sanskrit writers, and among other synonyms bears that of Arsoghna or "destroyer of piles." For medicinal use, Sarangadhara directs the tuber to be covered with a layer of earth, roasted in hot ashes, and administered with the addition of oil and salt. Several confections are also used, such as the *Laghuourana modaka, Vrihat surana modaka, &c.*; these are made of the tubers of the plant with the addition of treacle, aromatics (ginger and pepper) and Plumbago root, and are given in doses of about 200 grains once a day in piles and dyspepsia. The dried tubers of the wild plant, peeled and cut into segments, are sold in the shops under the name of *Madan-mast.* The segments are usually threaded upon a string, and are about as large as those of an orange, of a reddish-brown colour, shrunken and wrinkled, brittle and hard in dry weather; the surface is mammillated. When soaked in water they swell up and become very soft and friable, developing a sickly smell. A microscopic examination shows that the root is almost entirely composed of starch. Madan-mast has a mucilaginous taste, and is faintly bitter and acrid; it is supposed to have restorative powers, and is in much request; it is fried in ghí with spices and sugar. It is interesting to note that the tubers of the greater Dracontia (*Diosc.*, ii., 155) were preserved by the Greeks in the same manner for medicinal use. The cultivated plant is largely used as a vegetable; under cultivation it loses much of its acridity and grows to an enormous size.

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Synantherias sylvatica, Schott., is regarded by the Hindus as a kind of wild *Surana*, and, with the wild form of *Amorphophallus campanulatus*, bears the Sanskrit name of Vajra-kanda "thunder-bolt." The country-people use the crushed seed to cure toothache; a small quantity is placed in the hollow tooth and covered with cotton; it rapidly benumbs the nerve; they also use it as an external application to bruises on account of its benumbing effect. In the Concan the seeds rubbed into a paste with water are applied repeatedly to remove glandular enlargements. The fruit is yellow, about the shape and size of a grain of maize, closely set round the upper part of the spike, which is several feet in height, and as large as that of the plantain. The skin of the fruit is tough, the pulp scanty and yellow; it encloses two seeds having the shape of a coffee bean, and placed with their flat surfaces in apposition. The testa of the seed is soft, greenish-brown externally, green internally; the kernel is white, adhering closely to the testa, soft and juicy when fresh, but rapidly becoming hard and dry when cut. The taste is intensely acrid, after a few seconds it causes a most painful burning of the tongue and lips, which lasts for a long time, causing much salivation and subsequent numbness. A section of the fruit and seed show the following structure from without inwards:—*1st*, several rows of thick-walled cells, having yellowish-brown granular contents (skin); *2nd*, a parenchyma composed of thin-walled cells, having no solid contents except needle-shaped crystals (pulp); *3rd*, several rows of small cells containing chlorophyll (testa of seed); *4th*, a delicate parenchyma, the cells of which are loaded with very small starch granules, mostly round, some truncated.

The tubers of *Sanromatum pedatum*, Schott., are very acrid, and are used externally under the names of Bhasamkand and Lót as a stimulating poultice. The plant is extremely common, and its pedate leaves appear with the first rain in June. The flower, which is produced just before the rains, seldom attracts notice, being more or less buried in the soil. The tubers are about as large as small potatoes, and of the same shape as those of the Surana.

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CRYPTOCORYNE SPIRALIS, *Fisch.*

Fig.—*Wight Icon.*, *t.* 773.

Hab.—Marshy banks and standing water. Southern India. The rhizome.

Vernacular.—Nattu-ati-vadayam (*Tam.*), Nátti-ati-vasa (*Tel.*).

History, Uses, &c.—The Ati-vadayam of the Tamils is the Atís of Northern India, and is the tuber of *Aconitum heterophyllum*. The country Atís of the Madras Presidency has for a long time been undetermined, until in 1888 Mr. M. A. Lawson was able to refer it to *Cryptocoryne spiralis* and a species of Lagenandra. Moodeen Sheriff says the root bears a strong resemblance externally to Ipecacuanha, and he has used it as a tonic and anti-periodic with children. It attracted attention a few years ago through several packages of it appearing in the London market as "False Ipecacuanha." It is a well-known drug in Ceylon, where it is employed by the native doctors in decoctions in combination with other drugs as a remedy for infantile vomiting and cough, and in the case of adults for abdominal complaints and fever. The Singhalese obtain the drug from India and value it at 4 annas per pound retail.

Description.—Leaves petioled, linear-lanceolate; spathe sessile, much shorter than leaves, twisted; ovary 5-celled. The rhizome is about the thickness of a small quill. The drug appears in broken pieces from ½ to 1½ inch long, annulated, of grey or dark grey colour externally and white internally, inodorous and acrid in taste.

In the Cryptocoryne the annulations are not so frequent, and the drug is more slender than in the Lagenandra.

Chemical composition.—The drug contains starch and numerous bundles of raphides, but no alkaloidal active principle has been separated.

Lagenandra toxicaria, *Dalz.*, *Rheede, Hort. Mal. xi.*, *t.* 23, is a marsh plant, three feet high, with a thick, creeping,

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fleshy rhizome, juicy and white, sending off numerous thick fleshy roots of a white colour. The leaves are on long petioles, oblong, obtuse, entire coriaceous, large; sheaths stipulary, opposite the leaf; scapes axillary, solitary, compressed; spathe longer than the scape, tubular at the base, attenuated into a long, slender apex; fruit compound, about 1 inch in diameter; seeds cylindric-oblong, minute, several in each cell, erect from the base. The plant is a native of Southern India, and is considered to be very poisonous. Rheede says of it:—"Balneum ex hac planta præparatum omnem corporis æstum reficit."

Rheede (xii., 9) states that the root of *Remusatia vivipara*, Máravara Tsjembu (*Mal.*), Rukh-alu (*Mar.*), is made into an ointment with turmeric and used as a remedy for itch, and that the juice with cow's urine is considered to be alexipharmic.

TACCA ASPERA, *Roxb.*

Hab.—Tropical India. The tubers.

Vernacular.—Várâhi-kand (*Hind., Beng.*), Dukar-kand (*Mar., Guz.*), Handi-gadde (*Can.*).

History, Uses, &c.—This plant is the Váráhi-kanda or Súkara-kanda of the Nighantás, so called from its being a favourite food of the wild boar. It is described as sweet, digestive, nourishing and tonic; useful in cachectic affections, such as leprosy, &c. *T. aspera*, *T. lævis*, and *T. pinnatifida* all have tuberous roots, from which a starch resembling arrowroot may be obtained, and all three plants are probably utilized by the herbalists, who usually supply the coarsely prepared starch to their customers.

Description.—The root is an oblong curved tuber, of a middling size, with wiry fibres from its sides; externally of a dark-brown or blackish colour, and internally of a pale yellowish white. It has a bitter, nauseous taste. A full description of

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the plant, as well as of the two other species mentioned, will be be found in Roxburgh's *Flora Indica.*

PISTIA STRATIOTES, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 268; *Rheede, Hort. Mal. xi., t.* 32. Water soldier (*Eng.*).

Hab.—Tanks and ponds of India. The whole plant.

Vernacular.—Jal-Kunbhi (*Hind.*), Gondála, Shérval (*Mar.*), Agasatamaray (*Tam.*).

History, Uses, &c.—Amongst the Sanskrit names of this plant we may notice Jalodbhuta, Jalàsaya, Guccha-bodhra, and Paniya-prishthaja "born on the surface of water." This aquatic plant is a native of Asia, America, and Africa; it is considered by the Hindus to be cooling and demulcent, and is prescribed in cases of dysuria in the quantity of about ten pagodas' weight twice daily; the leaves are made into a poultice for the piles. (*Ainslie.*) The ashes are applied to ringworm of the scalp, and in some parts of India are known as 'Páná salt.'

A notice of the plant will be found in Arabic and Persian medical works under its Greek name στρατιώτης.

Description.—Often found floating on stagnant pools, leaves sub-rotund, obcordate, rosulate, waved on the margins, the nerves spreading like a fan, uniting into a truncate arc at the base; spadices axillary, solitary, seated on a short scape.

Chemical composition.—The plant and salt have been examined by Warden of Calcutta, who reports that the weed dried at 130°C. and carbonized yielded 31 per cent. of total ash, of which 6 per cent. was soluble. The sample of "salt" was slightly deliquescent, alkaline in reaction, and had the appearance of dirty common salt. Dried at 130° it yielded 73 per cent. of potassic chloride, 22·6 per cent. of potassic sulphate,

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and minute quantities of potassic carbonate, sodic chloride, calcic sulphate, magnesic sulphate, and ferric, aluminic and silicic oxides. (*Chem. News*, March 23, 1883, p. 133.)

DIOSCORINEÆ.

This genus is of much importance as a source of food in India, and some of the species are used medicinally on account of their acrid or bitter properties. In Sanskrit they bear the general name of *alu*, and the different species are distinguished by prefixes, *e.g.*, Madhválu "sweet yam" (*Dioscorea aculeata*), Pindálu "globose yam" (*D. globosa*), Raktálu "red yam" (*D. purpurea*), &c. But the Sanskrit name *alu* is also applied to other plants having tuberous roots, and it is therefore difficult to say what the original meaning of the word may have been. *Dioscorea bulbifera* in its wild state is extremely bitter; the small potato-like tubers on the vine dried and powdered are used as a medicinal application to sores, and are given internally in 4 massa doses with a little cumin and sugar in milk as a remedy for syphilis and for dysentery; the powder made into a bolus with butter is given to check diarrhœa; the roasted tubers of the cultivated variety made into balls with ghí and sugar-candy have a reputation as a remedy for piles: under cultivation the plant loses its bitterness, and is much grown for the tubers which are roasted and eaten.

D. triphylla is very acrid, and its tubers are sometimes used as a plaster to disperse swellings. We have received the tuber of this yam from Burma, where it is used as a poison; when taken internally it causes great irritation in the mouth and throat, vomiting of blood, a sense of suffocation, drowsiness, and exhaustion: and it is said that a piece of the tuber, the size of an apple, is sufficient to cause death in six hours. Nevertheless the Burmese use it as an article of food after it has been cut in thin slices, repeatedly washed, and steamed in an earthen pot. The Burmese name is Choo-ay-oo. In Sanskrit the tuber bears

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the name of Pàshpoli "strangle cake." For an account of the economic uses of the different species of Dioscorea cultivated in India, we must refer the reader to the *Dict. Econ. Prod. of India*, iii., p. 115.

The tubers yield a milky juice containing a small quantity of fat, a resin, and caoutchouc. Analysis of tubers—Water 60·722, Ash free from C, CO^2 and Si O^2 0·895, Protein compounds 4·485.

The following analyses of *D. alata* and *edulis* are by Payen (*Compt. rendus*, xxv., 1847, and Moser, *Landw. Versuchsst. Bd.*, 20, 1877).

	Dioscorea alata.	D. edulis.
Water	79·64	60·72
Nitrogenous matter	1·93	4·48
Fat	...	0·35
Nitrogen free extractive	17·33	32·47
Cellulose	...	1·09
Ash	1·10	0·89
In dry substances.		
Nitrogen	1·52	1·82
Carbohydrates	...	82·66

The nitrogen-free extractive of *D. alata* contained 4·79 per cent. cane-sugar, ·18 per cent. cellulose, and 25·19 per cent. starch.

CYPERACEÆ.

CYPERUS ROTUNDUS, *Linn.*

Fig.—*Rottl.* 28, *t.* 14, *f.* 2.

Hab.—Throughout India. The tubers.

Vernacular.—Motha (*Hind., Guz.*), Korai (*Tam.*), Bhadra-muste, Tunga-muste (*Tel.*), Bimbal, Bárik-motha (*Mar.*), Mutha (*Beng.*).

History, Uses, &c.—This is the Mustaka of Sanskrit writers; it is considered to be diuretic, diaphoretic, astringent,

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and stomachic, and is prescribed in febrile affections and derangements of the bowels. In Indian domestic medicine the fresh tubers are applied to the breast in the form of a paste as a galactagogue.

C. rotundus is doubtless the سعد (Suad) of Abu Hanifeh, who describes it as a certain kind of sweet-smelling root or rhizome (ارومه), round, black, hard like a knot, which is an ingredient in perfumes and medicines. In the *Kámús* it is said to possess a wonderful efficacy for healing ulcers and sores. Ibn Sina says that the best kind of Suad is that which comes from Kufa in Chaldea, and that the Indian drug (*C. scariosus*) is said to make the hair grow thin. He, along with other Arabian and Persian writers, describes the drug as attenuant, diuretic, emmenagogue, lithontriptic, and diaphoretic; they prescribe it in febrile and dyspeptic affections, and in one ounce doses as an anthelmintic; externally it is applied to ulcers, and used as an ingredient in warm plasters.

Dioscorides calls it κύπερος and notices its use as a diuretic and emmenagogue and as an application to scorpion stings and ulcers; he also states that it is an ingredient in warm plasters.

Herodotus (4, 71) notices it as an aromatic plant used by the Scythians for embalming. κύπειρον is mentioned in the Iliad (21, 351) and Odyssey (4, 603) and by Theophrastus in his fourth book; it appears to have been a favourite food of horses. Pliny (21, 18) calls it *Juncus triangularis* or *angulosus*; it is also probably the Juncus of Celsus (3, 21), mentioned as an ingredient in a diuretic medicine for dropsy, although he calls it *Juncus quadratus*.

Description.—Culms erect, 1—2 feet, triangular, with rounded angles; leaves radical; sheathing shorter than the culms; root tuberous, tubers often crowded together, size of filberts, brown or black externally, white internally, odour like that of Acorus; umbels terminal, compound; involucre 3-leaved, unequal; spikes linear, sub-sessile. Often a troublesome weed in cultivated ground.

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CYPERUS SCARIOSUS, *R. Br.*

Fig.—*C. B. Clarke, Linn. Soc. Journ. xxi.*, 159.

Hab.—Damp places in Bengal. The tubers.

Vernacular.—Nágar-motha (*Hind.*, *Guz.*), Nágar-mutha (*Beng.*), Lavála, Nágar-motha (*Mar.*), Muttah-kách (*Tam.*), Kola-tunga-muste (*Tel.*), Konnari (*Can.*).

History, Uses, &c.—This plant produces the aromatic tubers which have long been in use in Hindu medicine and perfumery under the Sanskrit name of Nágar-mustaka; they are considered to have the same medicinal properties as those of *C. rotundus.* Arabian and Persian writers mention this Indian Cyperus, but consider it to be inferior to *C. rotundus.* In the Concan, Nágarmoth, *Solanum indicum*, *Tinospora cordifolia*, Ginger and Emblic myrobalans, of each 2 tolás, are powdered and divided into 5 parts, and one part taken daily in decoction with a little honey and long pepper as a febrifuge. Several other prescriptions of a similar nature are used in fever, and will be found in the *Wanaushádi Prakasha.* In dysentery, Nágarmoth, Mocharas, Lodhra, Daitiphul (*Woodfordia floribunda* flowers), unripe Bael fruit, and the seeds of *Holarrhena antidysenterica* are ground with whey and molasses and given in 6 massa doses. In famine seasons Nágarmoth has proved a valuable resource to the poor.

Description.—The ovoid tubers of this plant are developed upon a thin underground stem, and are simple or branched, generally about 2 inches long and ½ an inch in diameter; the external surface is marked by a number of annular ridges, and is almost concealed by the remains of leaves; when these are removed, the colour of the tuber is a deep brown; a few wiry rootlets arise from its under surface, and at the lower end is a portion of the underground stem. The substance of the tuber is hard and of a reddish colour; it is divided into a central and cortical portion, the latter being of a darker colour. The odour is strongly aromatic like Acorus, but somewhat terebinthinate. The plant is aquatic and grows in the Concan in ponds and

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ditches along with *Scirpus subulatus*, Vahl.; both plants are called Laváli in Marathi, a name which appears to be equivalent to the English *Rush.*

Microscopic structure.—The outermost layer of the cortical portion is composed of large bundles of reddish-brown stony cells, separated from one another by interspaces; within it are from 6 to 8 rows of very thick-walled, empty cells; next a tissue of thick-walled cells, most of them full of large starch granules, but some containing essential oil and probably resinous matter. The central portion of the tuber is separated from the cortical by a single row of small yellow stone cells; it is composed of thick-walled cells full of starch like those in the cortical portion, but differs from it, inasmuch as many of the cells contain red colouring matter. Large vascular bundles abound in the root, some of them are surrounded by a layer of stony cells.

Commerce.—Two kinds of Nágarmoth are met with in this market—Surat and Kattiawar; the first is heavier and more aromatic than the second. Value—Surat, Rs. 2 per maund of 37½ lbs.; Kattiawar, Rs. 1¼. The Surat Nágarmoth is probably obtained from Rájputana, where the plant is common in tanks.

Scirpus Kysoor, *Roxb.* *Vern.*—Kasírú (*Hind.*), Kachara (*Bomb.*). The tuberous root found in tanks, about the size of a nutmeg, and of a black colour externally, has astringent properties, and is given in diarrhœa and vomiting.

We have met with two other species of Cyperus, yielding edible tubers. The one, called "Thegi" in Guzrathi, is probably *C. bulbosus*. It grows in the sand on the coast of Kattiawar, and is used as a bread-stuff at all times, and was of much value in the last famine. The tubers are ovoid and pointed, about ½ of an inch in length, horny and translucent, brittle when dry and farinaceous when powdered. The other is called "Pudhya" in Marathi; it grows in salt rice-fields, and is eaten in the Southern Concan. The tubers are half an inch or a little more in length, surface brown, with the remains of membranaceous sheaths arising from four transverse rings, hard, white and mealy within.

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The analyses of these tubers gave the following results:—

	Thegi.	Pudhya.
Fat	·73	·65
Sugar, &c. (spirit extract)	·82	1·64
Gum and carbohydrates	9·00	5·69
Albuminous matter	6·68	8·68
Starch	62·99	66·24
Fibre	6·78	4·51
Ash	3·60	2·06
Moisture	10·40	10·53
	100·00	100·00

The amount of nitrogen in the first was 1·07 per cent. and in the second 1·39 per cent. There were traces of an alkaloid in both tubers.

KYLLINGIA MONOCEPHALA, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 53; *Rumph. Amb. vi.*, 8, *f.* 2; *Rottl. Gr.*, 13, *t.* 4, *f.* 4.

KYLLINGIA TRICEPS, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 52.

Hab.—Throughout the Peninsula of India. The roots.

Vernacular.—Nirbisi (*Hind.*), Sveta-gothúbi, Nirbishi (*Beng.*), Mottenga, Pee-mottenga (*Mal.*), Musta (*Mar.*).

History, Uses, &c.—These plants are the Nirvisha of Sanskrit medical writers, who describe them as antidotal to certain poisons. Rheede describes *K. triceps* and *K. monocephala* as having similar properties, and states that the former plant is called *Coquinha* by the Portuguese. In Malabar a decoction of the roots is used to relieve thirst in fevers and diabetes, and oil boiled on the roots to relieve pruritus of the skin. He also states that they distil an oil from the roots, which is of a dark yellowish-green colour, pleasant odour and

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pungent taste, and which is used for the same purposes as the decoction and to promote the action of the liver.

Irving states that *K. monocephala* is used at Ajmere as an antidote like zedoary, and Roxburgh notices its use as an antidote in Bengal.

These plants have the odour, and apparently all the qualities, of *Cyperus rotundus*.

Description.—The roots are creeping, those of *K. triceps* bear tubers. The culms are erect and triangular, leafy at the base. The leaves membranaceous, flat towards the apex, ciliated with minute bristles on the margin and keel. The flower-heads of *K. monocephala* are solitary, globose, dense and white; whilst those of *K. triceps* consist of from 3 to 6 spikes, one of which is much larger than the rest. The involucres are 3 to 4 leaved, unequal, the longest leaf as long as the culm.

GRAMINEÆ.

ANDROPOGON SCHŒNANTHUS, *Linn.*

Fig.—*Royle, Ill., t.* 97; *Trin. Sp. Gr. iii., t.* 327. Rusa grass, Ginger grass (*Eng.*), Schænanthe des Indes (*Fr.*).

Hab.—Indian Peninsula, Western Ghauts, extending sparingly to the coast. The essential oil.

Vernacular.—Sugandha rosá, Rusá, Gandhis, Gandhbel, Mirchiya gandh (*Hind., Guz.*), Agiyá-ghás, Gandha-bena (*Beng.*), Sugandhirohisha, Rohishe-gavat (*Mar.*), Parimalada-ganjani (*Can.*), Sakanárú-pillú (*Tam.*).

History, Uses, &c.—This grass is the Bhustrina or Bhutrina "earth grass" of the Raja Nirghanta, and is also known as Rohisha in Sanskrit. Among the synonyms which it bears, we may mention Gandha-khéda and Gandha-trina "odorous grass," Su-rasa "well flavoured," and Su-gandha "having an agreeable odour." It is described as aromatic and stimulant and useful in bilious and phlegmatic affections.

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Mahometan writers upon Indian Materia Medica confound *A. Schœnanthus* with Izkhir (*A. laniger*), and Mir Muhammad Husain gives *Rús* as an Indian name for Izkhir; he also mentions several other Indian names, such as Gandhis, Gandhbel, &c., showing that he was well acquainted with Rúsa grass. The author of the *Tuhfat-el-muminin* mentions a distilled water prepared from Izkhir, and also an oil made by macerating the grass in sweet oil exposed to the sun; it is therefore probable that in his time (1669) the essential oil was not made from *A. Schœnanthus*. The industry probably commenced in the 18th century whilst Khandesh was in a flourishing condition under its Mahometan rulers.

A. Schœnanthus was first brought to the notice of Europeans by General Martin, who collected the seeds in the Balaghat, during the war with Tippu Sultan, and cultivated the plant at Lucknow, whence he sent seeds to Roxburgh, in Calcutta. The first mention of the oil is by Maxwell in 1825 (*Calcutta Med. Phys. Trans.*, i., p. 367); it was afterwards described by Forsyth, 1827 (*Ibid.*, iii., p. 213). The *A. Nardus* of Ainslie, which he calls ginger or spice grass, is doubtless the same plant; he notices its use in infusion as a stomachic, and states that an essential oil is prepared from it which is useful in rheumatism.

Preparation of the oil.—The oil distillers in Khandesh call the grass *Motiya*, when the inflorescence is young and of a bluish-white colour; after it has ripened and become red, it is called *Sonfiya*.* The oil obtained from it in the first condition has a more delicate odour than that obtained from the ripened grass. The Motiya oil is usually mixed with the second kind, which by itself would not fetch a good price in the European market. The grass grows freely, though not very widely, on open hill-sides in West Khandesh, especially in Akráni. The original seat of the manufacture was Pimpalner, but as the oil is in great demand, the manufacture has of late spread to Nandurbár, Sháháda, and Taloda. The makers are Musalmans, who, at the

* We are indebted to Mr. A. Lucas, Assistant Collector, Khandesh, for specimens of the Motiya and Sonfiya grasses from the distilling districts.

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close of the rains, about September, when the grass is ripening, buy it from the Bhils, stack it, and set furnaces at the sides of brooks where wood and water are plentiful. A large pit, four feet long by two wide and two and a half deep, is dug, and a furnace (*chula*) prepared. On this furnace is placed a copper or iron caldron, large enough to hold from 30 to 50 pots of water. After pouring in some water, the caldron is filled to the brim with chopped grass, and a little more water is added. The mouth of the caldron is carefully closed with an iron or copper plate, made fast with wheat dough. From a hole in this lid, a bamboo tube, wrapped in a piece of cloth, plastered with the flour of *Udid* (*Phaseolus Mungo*, Linn., black var.), and bound with ropes, passes into a second closed caldron, sunk to the neck in running water. The steam from the grass is condensed in the second caldron, which, when full, begins to shake. The tube is then skilfully removed, and the contents of the caldron poured into a third similar vessel and stirred. Then the oil begins to appear on the surface, and is slowly skimmed off. The distillate is returned with fresh grass to the still. In 1879-80 the number of stills was 197, producing about 71 cwts. of oil. More than 100 stills are worked in Nandurbár alone, and the increase of the manufacture is prevented only by the scarcity of the grass. The oil is packed in skins, and sent on bullock back over the Kundaibári Pass to Surat, and by Dhulia and Manmad to Bombay.

We are assured by the Bombay dealers that all the oil of commerce is more or less adulterated; and a comparison of the commercial article with some oil distilled by one of us supports this statement; the adulteration is said to be practised by the distillers, who, we are informed, are regularly supplied with oil of turpentine from Bombay. 373 lbs. of grass received from Khandesh and submitted to distillation under our own superintendence in Bombay yielded 1 lb. 5½ ozs. of oil. Portions of this oil were mixed with oils of turpentine, groundnut, rape, and linseed; with all three it formed a milky or turbid mixture, but the two first, after standing for some days, became perfectly bright. We are informed that formerly it was the custom to

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adulterate with groundnut oil, but that turpentine is now used, as it cannot be detected by the evaporation test.

The use to which Rúsa oil is put in Turkey, to which country it is principally exported, *viâ* Egypt and the Red Sea ports, from Bombay, was first explained by Hanbury (*N. Repert. f. Pharm.*, viii., 365), and in *Pharmacographia* we find the following interesting statement:—"No drug is more subject than attar of rose to adulteration, which is principally effected by the addition of the volatile oil of an Indian grass, *Andropogon Schœnanthus*, L. This oil, which is called in Turkish *Idris yaghi*,* and also *Entershah*, and is more or less known to Europeans as *Geranium oil*, is imported into Turkey for this express purpose, and even submitted to a sort of purification before being used.† It was formerly added to the attar only in Constantinople, but now the mixing takes place at the seat of the manufacture. It is said that in many places the roses are absolutely sprinkled with it before being placed in the still."

Description.—Root perennial, with long wiry fibres; culms erect, from 3 to 6 feet high, often ramous, smooth, filled with a spongy pith; leaves very long, tapering to a very fine point, smooth in every part, and of a soft delicate texture; sheaths, shorter than the joints on full-grown plants, with a membranaceous stipulary process at the mouth; panicles linear, subsecund; spikelets paired, but with only three joints; flowers also paired, one-awned, hermaphrodite and sessile, the other, awnless, male and pedicelled, the terminal florets are three, one hermaphrodite, sessile and awned, the other two male, pedicelled, and awnless.

Hermaphrodite calyx one-flowered, two-valved, base girt with wool, as is also the rachis and proper pedicels; corol one-valved,

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*عضرس, izris, pronounced *idris* by the Arabs, is a Persian word, and is explained in the *Burhán* as a kind of wild mallow which the Greeks call *Aluba* and the Arabs شحم لمراج (shahm-el-maraj). If a decoction of it with vinegar and oil is rubbed on the limbs it protects against venomous bites. It is perhaps *Pavonia odorata* or some other odoriferous plant belonging to the Malvaceæ.

† For particulars, see Baur (p. 262, note 3).

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a long black awn occupies the place of the other, which has two small filaments at its base; nectary two minute leaflets embracing the germ laterally; stamens, pistil, and seed as in the genus.

Male calyx as in the hermaphrodite; corol one-valved; nectary and stamens as in the hermaphrodite, no pistil. (*Roxburgh.*)

The oil of *A. Schœnanthus* distilled by one of us was dextrogyre, the ray being rotated 39° to the right by a column of 100 mm., and 78° by one of 200 mm. Some samples of the commercial oil rotated the ray about 13° to the right, and others had little or no effect upon it. The colour of the genuine oil was that of pale sherry; the commercial samples were more highly coloured. The odour at first resembles that of the rose, but there is a persistent and terebinthinate after-flavour which is not agreeable.

The taste is pungent and agreeable, approaching that of ginger.

Chemical composition.—The oil of this grass, which has been named *Geraniol* ($C^{10}H^{18}O$), is an alcohol belonging to the series $C^nH^{2n-2}O$. The two samples examined by F. W. Semmler (*Ber. d. D. Chem. Ges.*, 23, 1098), which yielded 90 per cent. of geraniol, must have been adulterated, as they turned a ray of polarised light 20° to the left, whereas the genuine oil distilled by one of us was strongly dextrogyre. Geraniol, which occurs also in *Pelargonium Radula*, Aiton, has a fragrant odour of roses, and is miscible with alcohol and ether; the boiling point at 17 mm. pressure is 120°·5—122°·5, and the refraction 48·71. With calcium chloride at 50° it forms a crystalline compound ($C^{10}H^{18}O$) Ca Cl^2, decomposed by water and slowly oxidised by air. Potash-fusion forms isovaleric acid. Neutral aqueous $K^2M_nO^4$ forms acetic and isovaleric acids. Even boiling baryta-water slowly forms isovaleric acid. Chromic acid mixture forms citral (*Semmler*). HNO^3 forms nitrobenzene, HCy, oxalic acid, and a resin, but no camphoric acid. (*Beilstein Chemie*, iii., 265; *Watts' Dict. Chem.*, 2nd Ed., ii., p. 609; *Ber. v. Schimmel & Co.*, April 1891, p. 37.)

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Commerce.—The official statistics only show the combined export of grass oils, and do not enable us to distinguish the different kinds. In 1888-89, 15,270 gallons of these oils, valued at Rs. 267,800, were exported.

As we have already stated, the production of Rusa oil in Khandesh, the chief source of the supply, does not much exceed 70 cwts. yearly. The value of oil of good quality in Bombay is about Rs. 3½ per lb. It is exported in pots containing about 40 lbs. each.

ANDROPOGON LANIGER, *Desf.*

Fig.—*Trin. Ic. Gr., t.* 326. Squinanch (*Eng.*), Schænanthe officinal (*Fr.*).

Hab.—Northern India to Tibet, Arabia, North Africa. The plant.

Vernacular.—Lámjak, Khavi, Usírbhéd (*Hind.*), Karankusa (*Beng.*), Pivala-vála (*Mar.*), Pilo-válo (*Guz.*).

History, Uses, &c.—This grass is described in the Nighantás under the Sanskrit name of Lámajjaka, with the synonyms Dirgha-mulaka "long-rooted," Jalasáya "aquatic," Sévya, Amrinála, Ishta-kápatha, &c., as cooling, useful in fever, and *trídosha* or derangement of the three humors. It is particularly mentioned by Arrian in his account of Alexander's journey through the Punjab and Sind, and was gathered in Lus by the Phœnician followers of the army, who called it spikenard. Dioscorides (i., 16) describes it under the name of σχοῖνος, and says that the best kind grows in Arabia, has an odour like roses when rubbed between the hands, and a pungent taste. It has carminative and stimulant properties, and is useful as an emmenagogue. This latter use of the plant is noticed by Hippocrates in his treatise on the diseases of women (Lib. ii., Sec. 5). The same plant was known to the Romans as Schœnus or Juncus odoratus, and was used to flavour wine (*Cato, R. R.* 105, 2; 113, 1. *Col.* 12, 20, 53), and from Plautus (*Pœn.* 1, 2, 55) we learn that it was used to prepare a perfume in favour with the

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Roman *meretrices* whom he speaks of as *Schœniculæ* or *Schœno delibutæ*. Scribonius Largus (*Comp.*, 167) mentions Schœnus, *i.e.*, Junci odorati flores, as an ingredient in a *theriace* used as an antidote to snake-bites, and Pliny also mentions it (12, 48) in his chapter on the sweet-scented Calamus. We are of opinion that the whole of this chapter refers to this grass, and that *the substance like a cobweb, which is generally known by the name of the "flower,"* and which he calls the pith, is really the cottony calyx of the plant which the Arabs call فقاح الاذخر (fukkah el idkhir) or the "flower of the Idkhir," and use as an hæmostatic. Other Arabic names for *A. laniger* are Kilal-el-Mámún "Mamun's toothpick," * Tibn-el-makah "Mecca grass," and Tib-el-Arab "the Arab's perfume." In Persia it is known as Gúrgiyah, and the author of the *Burhán* states that it bears this name because the onager or wild ass (Gúr) is particularly fond of it; he describes it as a grass, which, when chewed, has a taste of cloves and mastich, and which is called by the Arabs Idkhir.

Abú-Hanífeh Ed-Dínawarí, author of the *Book of Plants*, has the following description of the plant:—"It has a root hidden in the ground, slender, pungent in odour, and is like the straight stalks of the كولان (Kaulán or papyrus plant), save that it is wider, and smaller in the كعوب (ku'oub, internodal spaces), and it has a fruit resembling the blooms of reeds, but more slender, and smaller; it is ground, and is an ingredient in perfumes; it grows in rugged and in smooth grounds; but seldom does more than one grow in the same spot; when it dries becomes white."

The Arabian and Persian physicians describe Idkhir as hot and dry, lithontriptic, diuretic, emmenagogue, and carminative; they recommend it to be boiled in wine as a diuretic; ground into a paste it is said to be a good application to abdominal swellings; added to purgatives it is administered in rheumatism; the flowers (calyxes) are used as an hæmostatic. They identify it with the Schœnus of the Greeks.

* El Mámún, son of Hárún-el-Rashíd, the celebrated Caliph.

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In medieval Europe it was officinal under the names of Schœnanthus, Squinanthus, and Juncus odoratus, and was also known as Fœnum vel stramen camelorum "camel's hay or straw,". from its being the principle food of camels in the deserts between Syria and Egypt. In Arabia, under the name of *ghusúl*, the powdered grass is still used as a perfume for the bath.

Description.—This grass is distinguished by its simple rhizome, short thick tuft of radical leaves, and lanigerous calyx. The odour is like that of oil of Rhodium; the taste aromatic, bitter, and somewhat acrid.

Chemical composition.—From 56 lbs. of the dry grass purchased in the bazar we obtained the large yield of 8¾ ozs. of essential oil; it had a specific gravity of ·905 at 85° F., and rotated a ray of polarized light 8·0 degrees to the left in column 200 mm. long. The colour was that of pale sherry. According to Schimmel & Co., the essential oil reminds one of the odour of Elemi oil. Its sp. gr. is ·915, the optical rotation +34° 38′. It boils between 170° and 250°, and contains phellandrene (*Bericht von Schimmel & Co.*, April, 1892).

ANDROPOGON CITRATUS, *DC.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 280; *Rheede, Hort. Mal. xii., t.* 72. Lemon grass (*Eng.*), Chiendent-citron (*Fr.*).

Hab.—Eastern Archipelago? Cultivated throughout India. The herb and oil.

Vernacular.—Ágya-ghás, Agin-ghás (*Hind.*), Gandha-bena (*Beng.*), Hirva-chaha, Olen-chaha (*Mar.*), Lili-chahe, Nili-chahe (*Guz.*), Váshana-pulla (*Tam.*), Nimma-gaddi, Chippa-gaddi (*Tel.*), Vásana-pulla, Sambhára-pulla (*Mal.*), Purvali-hullu Vásane-hullu (*Can.*), Pengrima (*Cing.*).

History, Uses, &c.—This grass is not mentioned to our knowledge by any of the Hindu or Mahometan writers upon Indian medicinal plants. It was observed by Van Rheede early in the 17th century as an established and well-known cultivated plant, and it is not improbable that Hindu colonists

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returning from Java may have introduced it. The Hindus colonized that island in the 5th century, and in the 7th century there was much intercourse between the mother-country and the colony. In Java the grass is called Sireh; it was known to Rumphius and other early writers on the natural history of the East, and in 1717 an oil distilled from it in Amboyna was known as a curiosity. (*Ephem. Nat. Curios.*, cent. v—vi., Appendix 157, quoted in *Pharmacographia.*) Lemon-grass oil is mentioned by Roxburgh in 1820 as being distilled in the Moluccas, and it was first imported into London about the year 1832. An infusion of the fresh herb is a favorite native remedy in India as a diaphoretic and stimulant in catarrh and febrile conditions, and also in the congestive and neuralgic forms of dysmenorrhœa. The oil is used as a carminative and as an application in chronic rheumatism. The oil has been made official in the *Pharmacopœia of India*. Dr. Waring, in the appendix to this work, records a high testimony in its favour both as an external application in rheumatism and in other painful affections, and as a stimulant and diaphoretic internally. He states that amongst the half-castes of South India it is one of their most highly esteemed remedies in cholera. In infusion the leaves are often combined with tea, mint, or black pepper. The oil is distilled in rude stills at the Western base of the hills in Travancore, from Anjengo northwards. The grass is burnt at the end of the dry weather. In Europe the oil is now a well-known article of commerce under the names of Lemon-grass oil, Oil of Verbena, and Indian Melissa oil. It is employed as an ingredient in perfumes, such as Eau de Cologne, and for scenting soaps, and also for adulterating the "true Verbena oil" obtained from *Lippia citriodora* in Spain.

Description.—Root perennial, young propagating-shoots issue from the axils of the leaves that surround a short, subligneous leaf-bearing culm. Culms from 5 to 7 feet high, erect, simple, smooth, about as thick as a goose-quill. Leaves many, near the root bifarious, few on the upper part of the culm, of a soft texture, pale-green colour, slightly scabrous on

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the margins, otherwise smooth; from 3 to 4 feet long, including their sheaths, and about ⅜ of an inch broad. Floral leaves small. Panicle linear, a little bent to one side, composed of many fascicles of spikes that are both terminal and form the exterior axils. Spikes generally paired on a common peduncle, with a common boat-like spathe, or involucre at the division; each has also its proper pedicel, and both spathe-shaped. Rachis articulated, much waved, hairy. Flowers in pairs, one hermaphrodite and sessile, the other male and pedicelled; the last hermaphrodite flower of each spike has two males; below there is only one male, as the rachis occupies the space of the other. Hermaphrodite flowers sessile. Glume girt at the base with wool. Corol 2-valved, awnless. Nectary, two, broad, short, wedge-formed, obliquely lobed, crenulated bodies embrace the insertion of the filaments and the forepart of the germ. Male flowers pedicelled, calyx, glumes as in the hermaphrodite ones. Corol 1-valved, awnless. Nectary as in the hermaphrodite, stamens three. This grass flowers in the rains, but rarely.

Chemical composition.—The most interesting constituent of this oil is *Citral,* which has been examined by J. W. Semmler (*Ber. d. Deutsch. Chem. Ges.*, 23, 3556, and 24, 203). This author found that the aldehyde $C^{10}H^{16}O$, obtained by the oxidation of geraniol with chromic acid mixture, is identical with the citral of oil of lemons. By further oxidation with argentic oxide he prepared *Geranic acid*, $C^{10}H^{16}O^2$, a limpid oil, and by treating citral with acid sulphate of potassium, *Cymol* was formed, a molecule of water splitting off.

Up to the present time citral has been found by Messrs. Schimmel & Co. in the following essential oils:—

Lemon oil	from	*Citrus Limonum.*
Limetta oil	,,	*Citrus Limetta.*
Mandarine oil	,,	*Citrus Madurensis.*
Lemon grass oil	,,	*Andropogon citratus.*
Eucalyptus oil	,,	*Eucalyptus Staigeriana.*
Backhousia oil	,,	*Backhousia citriodora.*
Citronella fruit oil	,,	*Tetranthera citrata.*
Japan pepper oil	,,	*Zanthoxylon piperitum.*

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Commerce.—The oil is largely exported from Singapore and Ceylon, where the grass is cultivated. The shipments from the Malabar Coast during the last four years were as follows:—1887, 943 cases; 1888, 1,678 cases; 1889, 979 cases; 1890, 1,610 cases. The exports from Cochin have risen from 228 cases in 1884 to 2,387 cases in 1889 and 1,917 cases in 1890. A case contains 12 bottles of oil, and is priced at Rs. 18½. A bottle is guaranteed to hold 23 ounces of oil.

ANDROPOGON NARDUS, *Linn.*

Fig.—*Bentl. and Trim., t.* 297. Citronelle grass (*Eng.*).

Hab.—Ceylon, Travancore, cultivated at Singapore. The essential oil.

Vernacular.—Maana (*Cing.*).

History, Uses, &c.—This grass is considered by some botanists to be the wild form of *A. citratus*. Other grasses closely allied to it are *A. Khasianus*, Munro, growing in Silhet, and *A. distans*, Nees, growing in the North-West Provinces and in parts of the Bombay Presidency, but no oil has ever been distilled from these species, nor do they appear to be used medicinally by the natives.

A. Nardus is not mentioned in any Sanskrit medical work, nor do the Arabian and Persian medical writers notice it. It owes the name *Nardus* to its having been confounded with *A. laniger*, which was named νάρδος by the Greeks who invaded India. At the present time it is only known in Southern India and Ceylon, and the Hindi names which have been ascribed to it in the *Dict. Econ. Prod. of India* properly belong to *A. Schœnanthus* or *A. citratus*.

Description.—A large perennial herb, with a long slightly branched, partly aërial rhizome, reaching ½ inch in diameter, and strongly ringed with the closely-placed scars of the leaf-sheaths, the remains of which persist on the upper portion, and giving off numerous tough root fibres. Stem reaching 6 feet or more high, erect, stout, cylindrical, solid, smooth and shining, partially concealed by the leaf-sheaths,

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scarcely thickened at the nodes, which are approximated below, but widely separated above, flat or channelled on one side in the upper portion. Leaves very large and long, numerous, erect, lower ones sometimes reduced to their sheaths; sheaths thick and strong, about 6 inches long, closely but not entirely enveloping the stem, quite smooth, striate; ligule short, brown, laciniate, scarious; blade about 2 feet long, linear, very much attenuated at the apex, tapering below, minutely denticulate with forward points on the edges, smooth on both surfaces, pale somewhat glaucous green, lighter beneath. Spikelets very small, arranged in couples, one-stalked, containing one male flower, the other sessile, with one hermaphrodite and often one barren flower; the couples, to the number of 3 or 4, articulated on alternate sides of a short, flattened, jointed rachis clothed along the edges with long white silky hairs tufted beneath the spikelets, forming a short acute spike about $\frac{1}{2}$—$\frac{3}{4}$ inch long; the spikes arranged in pairs on a common slender stalk, at the bent basal node of which is a large, erect, acute, leafy, striate, orange-red, shining bract, scarious at the edges, which encloses the pairs of spikes before expansion; the pairs of spikes very numerous, placed on the somewhat zic-zac, elongated, smooth, slender, erect, flattened branches of elongated panicles, which come off in clusters from the axils of the upper leaves, the whole forming a very large tufted, elongated somewhat drooping inflorescence, often 2 feet or more in length; glumes nearly equal, acuminate, membranous, smooth, purplish, boat-shaped, the lower one of the sessile spikelet flattened on the back against the rachis and without a mid-rib, those of the stalked spikelets with several parallel strong veins; pales of the lower spikelet 2, or with a third representing a barren flower, very unequal, the lower very small, deeply bifid with two long cusps, from between which comes off a long, slender, slightly kneed purple awn, about twice the length of the glumes, and projecting considerably beyond the spikelet, the upper much larger, acute but without an awn, very delicate and membranous, without veins; in the flower of the upper spikelet there is but a single membranous non-awned

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pale. Lodicules 2, oblong, truncate, longer than the ovary. Stamens 3, anthers purple. Stigmas 2, spreading, protruded from the flower, plumose, bright red-purple. Fruit not united with the pales. (*Bentley and Trimen.*) The oil is of a pale yellow colour when pure. Mr. J. C. Umney (*Pharm. Journ.*, Ap. 11, 1891, p. 922) has shown that the green colour of the commercial oil is due to the presence of copper. According to Messrs. Schimmel, the sp. gr. should not fall below ·895 at 15°C. The oil is often adulterated with petroleum.

Chemical composition.—E. Kremers (*Proc. Am. Pharm. Assoc.*, 1887, p. 562) found the oil to consist of an aldehyde ($C^7H^{14}O$), a terpene ($C^{10}H^{16}$), an isomer of borneol, named Citronellol, and acetic and valeric acids. These two acids are said to be formed through the oxidation of the aldehyde and to exist originally in combination with citronellol as a compound ether. T. D. Dodge (*Am. Chem. Journ.*, 1889, p. 456) obtained somewhat different results. The aldehyde, isolated from the oil by means of a concentrated solution of sodium bisulphite, according to Kremers is $C^7H^{14}O$, while Dodge obtained results corresponding to $C^{10}H^{18}O$, and names the compound *citronellic aldehyde*. By the action of P^2O^5, an oily product, probably a terpene, was obtained. By heating the dibromide of the aldehyde the distillate contained a small quantity of oil having the odour of cymene, $C^{10}H^{14}$, thus confirming the statement of C. R. A. Wright (*Journ. Chem. Soc.*, 1875, p. 1). Oxidation with potassium permanganate yielded a mixture of fatty acids smelling strongly of valeric acid. A portion of the oil boiling at 77° C. was probably a terpene. The portion boiling at 222° C., probably *citronellyl alcohol,* $C^{10}H^{20}O$, the same as obtained by the reduction of citronellic aldehyde, the acetyl derivatives of both having the same characteristic rose-like odour.

ANDROPOGON ODORATUS, *Lisboa.*

Fig.—*Journ. Bombay Nat. Hist. Soc. iv.*, p. 188.

Hab.—Western Ghauts, extending sparingly to the coast. The grass.

Vernacular.—Vaidi-gavat, Usadhana (*Mar.*).

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History, Uses, &c.—This grass is not, to our knowledge, mentioned by Sanskrit writers, but is well known to the peasantry by the names given above, which signify "physician's grass" and "pungent grass." *A. odoratus* was first observed by one of us in 1875 as a grass growing sparingly at Tanna, near Bombay, and used by the natives as a carminative in the bowel complaints of children (*Mat. Med. of Western India*, 1st Ed., p. 693). In 1889 this grass was found growing abundantly at Lanowli on the Western Ghauts by Mrs. J. C. Lisboa, and was described and figured in the *Journal of the Bombay Natural History Society*. We have since distilled the grass and obtained from it an essential oil having at first an odour recalling that of cassia and rosemary, but afterwards a strong persistent odour of oil of cassia. Messrs. Schimmel & Co. notice the odour of Pine needle oil in this sample, and find the sp. gr. to be ·945.

Description.—Root as in *A. Schœnanthus*. Culm erect, 3—5 ft. high, sometimes branching from the lower part, glabrous; nodes long-bearded. Leaves lanceolate, cordate at the base, acute or acuminate, with a few long hairs; the lower cauline and radicle leaves long, the upper small, but their sheaths very long. Ligula small. Spikes numerous, erect, branched, pedicellate (the pedicel of the lower spikes longer), and congested at the end of a long peduncle without a sheathing bract and forming an erect, dense, ovoid panicle. The rachis, pedicel, and the spikes covered with long silky hairs. Spikelets nearly two lines long, of a purple colour, the sessile and the pedicellate nearly similar; outer glume of the sessile spikelet rather thin, many-nerved, somewhat obtuse and covered with long silky hairs, with a pit in some spikelets of the same plant and absent in others; second glume as long as the first or a little longer, but broader, thin, and keeled; third glume thinner and hyaline; fourth glume, smaller or an awn ½—1 inch long, with a hermaphrodite flower at the end of the pedicel. Pedicel of the pedicellate spikelet covered with white hairs, but the spikelet almost free of hairs. Outer glume stiff, with five or more nerves, not prominent, almost

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obtuse; second glume thinner, with three nerves, somewhat broader, but as long as the first; third glume hyaline, smaller; fourth glume very small, hyaline or none; no awn; at the top of the pedicel three stamens not well formed and not as large as in the hermaphrodite flower. (*J. C. Lisboa.*)

The yield of oil from the grass was equal to that obtained from *A. Schœnanthus*; it had a deep sherry colour, a specific gravity of ·931 compared to an equal volume of water at 84° F., and a rotatory power of —22·75 in a column of 100 mm. or $(a)^{D} = -24{\cdot}43$.

ANDROPOGON MURICATUS, *Retz.*

Fig.—*Beauv. Agr., t.* 22. Cuscus (*Eng.*), Vettivér (*Tam.*), Chiendent des Indes (*Fr.*).

Hab.—Coromandel, Mysore, Bengal, Northern India. The roots.

Vernacular.—Khas, Bála, Panni (*Hind.*), Khaskhas, Bená (*Beng.*), Vála, Várélu (*Mar.*), Válo, Khaskhas (*Guz.*), Vettivér (*Tam.*), Vattivéru (*Tel.*), Báladvéru (*Can.*).

History, Uses, &c.—The root of this grass, which is the only part of the plant having aromatic properties, is described in the Nighantás under the name of Usíra, and bears among other synonyms those of Virana, Véni-mulaka "having braided roots," Sugandhi-mulaka "having sweet-smelling roots," Sita-mulaka "having cool roots," &c. It is considered to be cooling, refrigerant and stomachic, removing bile and phlegm, and useful to allay thirst in fever and inflammatory affections. An infusion is used, and it enters into the composition of several cooling mixtures. Sir W. Jones suggests that it is the *Mrinála* mentioned in Kalidasa's *Sakuntala*, but that name is more commonly applied to the leaf-stalk of the Lotus than to the roots of this grass. All parts of the Lotus are renowned for their cooling properties, and the use of the Water Lily for Sakuntala's complaint appears to us to be more poetical. In Vedic times the ancient Hindus were instructed

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to build their houses in a place where the Virana and Kusa were abundant, and on some copper-plate inscriptions discovered near Etawah, dated A.D. 1103 and 1174, this plant is mentioned as one of the articles upon which the kings of Kanauj levied imports (*Proc. As. Soc. Bengal*, 1873, p. 161). Externally it is used in a variety of ways: a paste of the root is rubbed on the skin to relieve oppressive heat or burning of the body; an aromatic cooling bath is prepared by adding to a tub of water the root in fine powder, together with the root of *Pavonia odorata*, red sandalwood and the wood of *Prunus Puddum*. The same ingredients are applied in the form of a thin paste to the skin. (*Chakradatta.*)

All over India the roots are made into aromatic scented mats, hung in door-ways, and kept wet to cool and perfume the atmosphere during the hot season; they are also much used for making fans, ornamental baskets, and other small articles. When distilled with water, the roots yield a fragrant oil, which is used as a perfume and for flavouring sherbet. Mir Muhammad Husain, in the *Makhzan-el-Adwiya*, describes *khas* as a kind of Izkhir used in India, known as Izkhir-i-Jámi and called by the Persians Bikh-i-wála. European physicians in India have used the root as a diaphoretic, and Pereira (*Mat. Med.*, ii., Pt. I., p. 132) states that in 1831 it was used in Paris and Hamburg as a preservative against cholera, being hung up in rooms and burnt as a fumigatory. In 1837 it was recommended by Foy in rheumatism and gout. At the present time the root is distilled in Europe to obtain the oil, which commands a high price, being used in the composition of many favourite perfumes, as "Mousseline des Indes," "Maréchal," "Bouquet du Roi," &c.

Description.—*A. muricatus* has an erect compressed culm, 5 to 6 feet high, with smooth nodes and linear-narrow sub-bifarious rigid elongated leaves; the panicle is verticelled; the branches are very numerous, simple and spreading; the joints of the rachis are smooth; the glumes are minutely prickly on both sides, sub-equal, muricated. The radicles are

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very numerous and spring from a rhizome, on the upper surface of which are leaf-buds. The entire root is of a yellowish-brown colour, and has a strong and persistent odour, somewhat like myrrh ; the taste is bitter and aromatic.

Chemical composition.—Khaskas has been analysed by Vauquelin, who has obtained from it a resinous substance of a deep red-brown colour, having an acrid taste and an odour like myrrh ; a colouring matter soluble in water ; a free acid ; a salt of lime ; a considerable quantity of oxide of iron ; a large quantity of woody matter. (*Annales de Chimie*, lxxii., p. 302.)

The oil is difficult to extract; this difficulty may be overcome by placing the roots in a steam-jacketted still with just sufficient water to drench them, allowing to stand for a short time, and then admitting steam at about 15 lbs. pressure into the jacket, when a light oil will come over. A current of steam afterwards admitted into the still and raised to 25 lbs. pressure will bring over the heavier portion of the oil. Piesse states the yield to be 10 ozs. per cwt.

COIX LACRYMA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 79; *Rheede*, *Hort. Mal. xii.*, *t.* 70. Job's tears (*Eng.*), Larmes de Job (*Fr.*).

Hab.—Plains of India and warm hill-slopes from the Punjab to Burma. Cultivated on the hills. The seeds.

Vernacular.—Sankhru, Sankhlu, Gargari-dhàn (*Hind.*), Gargar, Kunch (*Beng.*), Rán-jondhala, Rán-makai (*Mar.*), Kasái (*Guz.*).

History, Uses, &c.—The different species of Coix bear the Sanskrit names of Gavídhuka, Gavedhu, and Gavedhuka. They are mentioned in Vedic literature, and appear to have been one of the cereals which were cultivated by the Arians on the hill-slopes of the Himalayas. They are still cultivated by the hill-tribes in the Khasia and Naga Hills and in Assam and Burma, where they are known by the vernacular names of Kasi, Kulésé, Kalinsi, Kyeit, &c., and are

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used as a food-stuff. The wild form, common in the plains, is only used for medicinal purposes, and is considered to be strengthening and diuretic. The Arab travellers in the East became acquainted with the seeds and named them Damu Dáud "David's tears," and afterwards Damu Ayúb "Job's tears." Es-Sághâni, who died about the year 1260, mentions them in the *Obáb* as a well-known strengthening and diuretic medicine. The Arabs introduced the plant into the West, and it has become naturalized in Spain and Portugal, where it is still known as *Lagrima de Job.* European botanists have rather inappropriately given the name of Coix (Greek κοιξ) to this genus, Coix being the name of a kind of palm growing in Africa and mentioned by Theophrastus and Pliny.

The following notice of *C. lacryma* occurs in the *Descriptive Catalogue of the Vienna Exhibition*, 1873:—"The seeds known as Job's tears are used as food in China and Malacca, under the name of Eejin or Ee-yin. 'It is,' we are told, 'the most remarkable among food-grains for its chemical composition.' Dr. Smith writes that 'it is larger and coarser than pearl-barley, but it is equally good for making gruel. As it is sold for five pence per Chinese pound, it makes an excellent diet-drink for hospital patients in China.' Dr. Hooker observes that 'a great deal of Coix is cultivated in the Khasia Hills; the shell of the cultivated sort is soft and the kernel is sweet, whereas the wild Coix is so hard that it cannot be broken by the teeth; each plant branches two or three times from the base, and from seven to nine plants grow in each square yard of soil; the produce is small, not above 30 or 40 fold.' In Mason's '*Burmah*' it is stated that a species of Coix, with large esculent seeds, which are parched like Indian corn, are often for sale in the bazars, and are cultivated very extensively by the Red Karens."

C. lacryma has also been introduced into Brazil, where it is cultivated to some extent. For much interesting information concerning the different species or varieties of the plant, and the economic uses to which the seeds are put, we must refer the reader to the *Dict. Econ. Prod. of India*, ii., p. 492.

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Description.—The silicious involucre of this grass containing the seed is sold in the drug shops. It is about the size and has much the appearance of a small cowrie shell, shining white, and very hard. At the base is a scar marking the attachment of the peduncle; at the apex an opening, from which, even in the dry state, a portion of the female flower may be seen protruding. In the fresh state a spike of male flowers, from one to two inches long, rises from it.

Chemical composition.—Church (*Food Grains of India*) found the edible grain, separated from the husk, to contain water 13·2, albuminoids 18·7, starch 58·3, oil 5·2, fibre 1·5, ash 2·1 in 100 parts. Peckholt, who examined the seeds grown in Brazil, ascertained that 1000 parts afforded (among less important constituents) fatty oil 6·6, resin 3, sugar 7, starch 84, husks and shell 696 parts. (*Cat. of the Exhibition of* 1866 at *Rio de Janeiro.*)

ERAGROSTIS CYNOSUROIDES, *Rom. et Sch.*

Fig.—*Delile, Descr. de l'Egypte, t.* 10; *Rheede, Hort. Mal. xii., t.* 57.

Hab.—Throughout the plains of India. The herb.

Vernacular.—Kusa, Darbha (*Hind.*), Kusha (*Beng.*), Darbha, Kusha (*Mar.*).

History, Uses, &c.—In Hindu ritual the Kusa occupies much the same position as the Durva and Tulasi. Among the synonyms for this grass are Darbha, Barhis "that which is plucked up," Suchy-agra "needle-pointed," Yajna-bhushana "ornament of sacrifice," Dirghapattra "having long leaves," Vajna "lightning," Suchi-mukha "needle-mouthed," Punyatrina "holy grass," &c. Its pointed leaves are used for the purification of sacred beverages, and spread beneath the sacrificer and the sacrifice, like the Vervein was amongst the Romans. In the Vedas this plant is often invoked as a god: "Thee, O Darbha, the learned proclaim a divinity not subject to age or death; thee they call the armour of Indra, the preserver of regions, the destroyer of enemies; a gem that gives

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increase to the field; at the time when the ocean resounded, when the clouds murmured, and lightning flashed, then was Darbha produced, pure as a drop of fine gold" (*Atharva Veda*). The Vedic rituals furnished instructions for its use. According to Ásvalayána, two pieces without knots were used for purifying butter—one was to be held in each hand between the thumb and the fourth finger, the second and third fingers being raised. Turning towards the East, Savitri, Vasu, and the Sun's rays were invoked. At the new and full moon they fasted and tied together Kusa and firewood, hence the name Kusákara for fire, the sacred fire being made upon a tuft of the grass. At the time of the first cutting of a child's hair, the father took a position to the south of the mother, and, holding in his hand twenty-one blades of the grass (to represent the twenty-one Maruts or winds), invoked Vayu, the god of wind. The father, or, in his absence, a Brahmin, then took three blades of the grass and thrust them, points foremost, into the child's hair, saying, "O herb protect him." The Vedic homestead was directed to be built in a place where the Kusa and Virana grew, its foundations were to be strewed with the grass, and all prickly herbs, as the *Apamarga*, the *Saka*, the *Tilvaka*, and the *Parivyádha*, were to be extirpated. When they learned the sacred books, students used to sit upon a spot of ground strewed with the Kusa, and on leaving they carried away, amongst other things, some blades of the grass as a remembrance and good omen. In the Brahmanic period the Kusa was used in invoking Vishnu; anchorites covered their nakedness with the grass, or with the skins of animals and bark of certain trees. In modern times it is in constant requisition in Hindu ceremonial, and at funerals the chief mourner wears a ring of the grass upon his finger, and it is placed beneath the *pîndas*. Brahmins place it in the hands of pilgrims when they bathe in the sacred Ganges. M. Sénart draws a comparison between the Vedic *Kusa* and the Beresman of the ancient Persians, and explains its significance in Buddhic ritual: it serves as a sacred prayer-carpet which is presided over by the divine Intelligence. As a medicine it enters into

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compound prescriptions for dysentery and menorrhagia, and is specially used as a diuretic. It is often confounded with *Cynodon dactylon* by the herbalists, or perhaps they consider both grasses to be equally efficient.

Description.—Root creeping, perennial. Culms straight, rigid, round, smooth, from 1 to 3 feet high. Leaves numerous, very long, chiefly about the base of the culms, rigid margins hispid. Panicle erect, linear-oblong, often tending to a conical form, composed of many somewhat threefold, verticelled, horizontal, short, rigid, secund ramifications. Spikelets many-flowered, depending, in two rows, from the under-side of the ramifications. Valves of corolla pointed, the inner one rather the largest.

CYNODON DACTYLON, *Pers.*

Fig.—*Eng. Bot. xii., t.* 850; *Fl. Græc., i., t.* 60. Creeping Dog's-tooth-grass (*Eng.*).

Hab.—Plains of India, westward to the south of England. The herb.

Vernacular.—Durvá, Dúb, Hariyáli (*Hind.*), Durba (*Beng.*), Durvá, Harala, Haryéli (*Mar.*).

History, Uses, &c.—This grass must have first attracted the attention of the ancient Hindus by its value as a food for their cattle. A modern Indian proverb says—Zamindári dúb ki jár hai (an estate like the roots of the Dúb, *i.e.*, is always bearing). The plant has many synonyms in Sanskrit, such as Granthi "knotted," Sveta "white," Bhárgavi "belonging to Sukra" (the regent of the planet Venus), Ruha "growing," Dur-mara "not easily dying," &c. Nanak Shah thus apostrophizes himself:—

> Nanak! nannhá ho raho jaisi nannhi dúb!
> Aur ghás jal jáengi, dúb khúb ki khúb.
> Be modest Nanak! as the fresh soft *Dúb* doth lowly lie,
> Whilst other grasses scorched up are, the *Dúb's* bloom ne'er doth die. (*Fallon.*)

In the *Rig-Veda* (x., 134) misfortunes are prayed to depart like the Dúrva whose seeds fall far from the plant; an allusion to the far-spreading habit of this grass, which has also given

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rise to the proverbial expression "Dúb ki nal" (the sheath of the Dúb) as applied to family connections, so called from their tendency to spread far and wide like the Dúb. Like other useful plants this grass was deified by the Hindus; in the *Atharva-Veda* it is thus addressed— "May Dúrva which rose from the water of life, which has a hundred roots and a hundred stems, efface a hundred of my sins, and prolong my existence on earth a hundred years." The Hindus believe that a benevolent Apsaras or nymph dwells in the plant, and when they build a house they place the grass on the four corners of the foundations. This practice dates from Vedic times.

Dúrva is also spoken of as Dúrveshtaka, from its being used in erecting an altar; it is sacred to Vishnu and Ganesha, and a festival called the Dúrváshtami is held in its honour on the eighth day of the light half of the month Bhadra; at this festival the male worshippers wear the grass tied to the right arm, and the females tied to the left. At marriages the right arm of the bridegroom is tied to the left arm of the bride with Dúrva; it is a phallic emblem, like the *fétu* or straw was in Europe. In the third act of the *Vikramorvasi* of Kálidasa, Urvasi shows herself to Purúravas with her hair decked with Dúrva, a symbol that she accepts his love. De Gubernatis says:—"A Pésaro, le jeune paysan, lorsqu'il désire demander en mariage la jeune fille qu'il aime, ôte du pailler un fétu de paille et, en le lui montrant, lui demande si elle veut entrer dans sa maison." According to Ásvaláyana and Náráyana, the husband, in the third month of his young wife's pregnancy, should squeeze the juice of the Dúrva into her right nostril to secure a male child; this practice is still customary in Western India and probably elsewhere. Dúrva is one of the eight ingredients of the *Arghya*, a respectful oblation made to gods and venerable men. The popular version of the *Ramayan* mentions the eight ingredients in the following couplet:—

Dahi, Dúrba, rochan, phal múlá
Nav tulsi dal, mangal múlá,

i.e., curdled milk, dúrba, rochan, flowers and roots, young leaves of the Tulsí and Lotus, turmeric.

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According to the *Panchatantra*, Dúrva was born from the hairs of a cow; in a strophe quoted by Böhtlingk (*Ind. Spr.*, ii., 2921), the leaf is described as the ornament of the Dúrva, like the flower of the tree, independence the ornament of man, and the husband the ornament of the wife; happy are the gazelles who eat the Dúrva, for they see not the face of rich fools. Dúrva is mentioned in the Nighantás; medicinally the fresh juice is considered astringent, and is used as a snuff in epistaxis. The bruised grass is a popular application to bleeding wounds. The Indo-Portuguese call it *gramina*, and use it as a substitute for *Triticum repens*, L., which is generally considered to have been the ἄγρωστις of the Greeks, and Gramen of the Romans, though some authorities are of opinion that both *T. repens* and *Cynodon dactylon* were used indiscriminately by the ancients.

Description.—The roots are tough and creeping, almost woody, with smooth fibres. Stems also creeping to a great extent, matted, round, jointed, leafy, very smooth. Leaves tapering, sharp-pointed, ribbed, hairy, a little glaucous; with long striated smooth sheaths, and a hairy stipula. Flowering branches a span high, leafy, simple, terminating in 4 or 5 nearly equal, crowded, erect, many-flowered linear spikes; the common stalk of each triangular, roughish; flat and slightly bordered on one side, along which the nearly sessile, shining, purplish flowers are ranged in two close alternate rows. The corolla is longer than the calyx, very much compressed, opposite with respect to the latter.

ZEA MAYS, *Linn.*

Fig.—*Lam., Ill., t.* 749; *Bentl. and Trim., t.* 296. Maize, Indian Corn (*Eng.*), Maïs, Blé turc (*Fr.*).

Hab.—S. America and West Indian Islands. The stigmas and meal.

Vernacular.—Makkái, Bhuta (*Hind., Guz.*), Janar (*Beng.*), Makkái, Bonda (*Mar.*), Makka-sholom (*Tam.*).

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History, Uses, &c.—A wild form of this cereal is said to be still found in some of the West Indian Islands. The vernacular names point to its introduction into India from Mecca, but the Durah-i-Makka or Gandum-i-Makka of Mahometan writers on Materia Medica, which they also call Khanderús (χόνδρος), is the *Sorghum vulgare* or Great millet, the *Juar* of Northern India, and the *Sholam* of Madras. The Arabs call *Zea Mays* Durah kízán or Durah shámí. We learn from Chinese literature that it was cultivated in China in the 16th century, and was then traditionally asserted to have been an introduction from the west. On the Continent of Europe, it is best known as Turkish corn. It is now cultivated in all warm countries, and is considered by Mahometan physicians to have properties similar to those of *Sorghum vulgare, viz.*, resolvent, astringent, and very nourishing; they consider it to be a suitable diet in consumption and a relaxed condition of the bowels. In Europe it is much used as a valuable article of diet for invalids and children under the names of *Polenta* (Maize meal) and *Maizena* (Maize flour). In Greece the silky stigmata are used in decoction in diseases of the bladder, and have lately attracted attention in America under the name of *Corn silk*, of which a liquid extract is sold in the shops as a remedy in irritable conditions of the bladder with turbid and irritating urine; it has a marked diuretic action. The meal has been long in use in America as a poultice, and gruel is also made of it. In the Concan an alkaline solution is prepared from the burnt cobs and is given in lithiasis.

In the United States for starch manufacture from maize it has been found desirable to get rid of the oily embryo—this is done by machinery. The embryo is too rich for feeding stock unless the oil is removed—this is done in the hydraulic press, and the cake when ground into meal is very valuable as a food for stock. The oil promises to be useful for medicinal purposes instead of olive oil. In the unrefined state it has a specific gravity of ·916 at 15°C., the elaidin test shows the presence of a large quantity of olein. Maize oil is of a pale

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yellowish-brown colour, with an odour and taste like that of freshly ground corn meal; it belongs to the non-drying group of the vegatable oils, does not easily become rancid, and has no purgative action. With alkalies it forms a white soap; it contains fatty acids (free) 0·88, total fatty acids 96·75 per cent., mucilaginous bodies 1·34. The loss sustained by purification is under 5 per cent. (*J. U. Lloyd, Amer. Journ. Pharm.,* July 1888.)

Chemical composition.—The average results of the analysis of three varieties of maize in an undried state by Polson, yielded in 100 parts, 54·37 starch, 8·83 nitrogenous substance, 4·50 fat, 2·70 gum and sugar, 15·77 cellulose, 12·16 water, and 1·67 ash. Poggiale found on an average in 160 parts of the dried grain, 64·5 starch, 6·7 fat, and 9·9 nitrogenous substance. Church found it to contain water 12·5, albuminoids 9·5, starch 70·7, oil 3·6, fibre 2·0, ash 1·7. American grain contained 1 per cent. more fat than Indian.

The following figures, quoted by König, represent the mean composition of 145 samples examined by various analysts :—

	Minimum.	Maximum.	Mean.
Water	7·40	22·40	13·12
Albuminoids	5·54	13·90	9·85
Fat	1·61	8·89	4·62
Nitrogen-free extractive	60·49	74·92	68·41
Cellulose	·76	8·52	2·49
Ash	·61	3·93	1·51

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The stigmata have been examined by C. J. Rademaker and J. L. Fischer (*Amer. Journ. Pharm.*, 1886), with the following results :—

Fixed oil (petroleum spirit extract)	5·25
Resin, crystalline principle, and chlorophyll (ether extract)	2·25
Resin, crystalline principle, and chlorophyll (alcoholic extract)	3·25
Sugar, gum, and extractive (water extract) ...	19·50
Albuminoids, phlobaphene, &c. (from alkaline solution)	3·50
Salts and extractive (from acid solution)	5·50
Cellulose	37·00
Water	20·00
	96·25

LOLIUM TEMULENTUM, *Linn.*

Fig.—*Engl. Bot. xvi., t.* 1124; *Schreb. Gram. ii., t.* 36; *Bentl. and Trim.* 295. Bearded Darnel (*Eng.*), Ivraie (*Fr.*).

Hab.—A weed of cultivation. Asia, Europe, North Africa. The seeds.

Vernacular.—Múchhni (*Hind.*).

History, Uses, &c.—A noxious weed growing with wheat called αἰρα is mentioned by Theophrastus (i., 5), and by Dioscorides (ii., 91); the latter writer notices its medicinal use as an external application along with salt and radishes to ulcers, and with sulphur and vinegar to certain skin eruptions, also with pigeon's dung and linseed to disperse or mature glandular and gouty swellings. It was also used with bitumen, myrrh, saffron or frankincense as a fumigatory to promote conception. This plant was known to the Romans as Lolium, and is mentioned by Virgil (Georg. I) as "*infelix lolium.*" Ovid (Fast, i.) speaks of it as injurious to the eyesight, "et careant loliis oculos vitiantibus agri." Pliny

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mentions it in his chapter upon the diseases of grain (18, 44), and again (22, 58, 77) reproduces the account given by Dioscorides of its medicinal uses. The Arabian lexicographers describe the same plant under the name of Zúwán or Ziwán (زوان) as a noxious weed growing among wheat, which often gives a bad quality to it when accidentally mixed with it, causing giddiness; they consider it to be the same as the plant called Shailam (شيلم). Abu Hanifeh says, that Shailam is a small, oblong, red, erect grain, resembling in form the سوس (or grub) of wheat; and it does not intoxicate, but renders the wheat very bitter; and in one place he says the plant spreads on the ground, and its leaves are like those of the willow.

Ibn Sína describes Zúwán and Shailam separately, but in his account of their properties there is hardly any difference, it being essentially the same as Dioscorides' description of Aira. He states, however, that both are narcotic.

Forskal considers Zúwán and Shailam to be different. Of the former he says:—"Zizania Allepensibus notissima: inter triticum viget: si semina restant farinæ (sic) mixta, hominem reddunt ex panis esu temulentum: messores plantam non separant; sed post triturationem vanni aut cribri ope semina rejiciunt." Of the latter he says:—"Shalim etiam agri vitium; a priore (ziwau) tamen diversa species; decocto plantæ obtunduntur sensus hominis qui operationem chirurgicam subire debet; Avicenna sic referente." (*Fl. Ægypt Arab.*, p. 199.)

Indian Mahometan writers merely copy the Arabians, and we have met with no mention of Darnel by Hindu physicians. In Persia the plant is known as Samuk and Gandum-i-diwáheh "fools' wheat." In Northern India it is called Múchhni "bearded"; it does not appear to be known in the Peninsula or Bengal.

Description.—Annual. Roots a few downy fibres. Stems annual, erect, 3 feet or more in height, stiff, smooth, often branched from the lower nodes. Leaves large, distant; sheaths smooth, striate, ligule short, truncate, blade 5 to 10

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inches long, spreading and drooping, ¼ to ½ inch wide, linear, gradually tapering to the acute apex, dark green. Spikelets large, ½ to 1 inch long, 5 to 11 flowered, sessile, laterally compressed, blunt, arranged singly edgewise alternately on opposite sides of the elongated rachis, forming a narrow distichous spike, 6 to 12 inches long; rachis somewhat flexuose, hollowed on alternate sides to receive the spikelets, faintly rough; glumes 2 in the terminal spikelet, nearly equal, only one in the remainder, placed on the outer side of the spikelet, closely appressed, and equalling or exceeding it in length, rather leaf-like, 5-ribbed, convex, smooth, green, subacute, not awned; pales 2, nearly equal in length, the lower rounded on the back, the edges somewhat involute, 5-ribbed, the two outside ribs very strong, obtuse, and membranous at the apex, a little below which arises usually a straight white awn of variable length, the upper pale flat, appressed to the dorsal one, with its margins folded over on the inside, scarious, with two green veins, faintly ciliate on the edges. Lodicules 2, connected at the base, entire. Stamens 3, ovary rounded. Stigmas 2, aspergilliform. Fruit enclosed in the pales (the lower one turgid and thickened), oblong-ovoid, nearly ¼ inch long, blunt, concave on inner surface, pale brown.

Chemical composition.—Filhol and Baillet found the seeds to contain 50 per cent. of starch, albuminoids, and the other constituents found in cereal grains; also a thick, almost concrete green oil, one portion of which was saponifiable, and the other not. It was insoluble in water, but freely soluble in alcohol and ether. The seeds besides contained an extractive substance soluble in water and alcohol. The non-saponifiable portion of the oil they describe as producing tremulousness when swallowed, but without any narcotism; and the extractive as narcotic. Both substances proved fatal to animals.

Ludwig and Stahl, besides starch, gluten, &c., found two acrid oils soluble in alcohol, but insoluble in water; and an acrid bitter glucoside, soluble in water; they attribute the activity of the seeds to the combined influence of these different principles.

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The still more recent experiments of Wittstein have convinced him "that the poisonous characters of the seeds are not due to an acid body, nor to a base, but to an indifferent body which is incapable of forming compounds with lead or zinc, and may be completely extracted from the seeds by water or alcohol, and only incompletely by ether."

Dr. P. Antze, who has recently examined the constituents of the plant, both chemically and physiologically, reports (*Arch. f. exp. Path. und Pharm.*, Nov. 1890, p. 126) the isolation of a volatile alkaloid, *loliine*, and *temulentic acid*, which by the action of lime yields a base, *temulentine*, as a decomposition product. Loliine is said to yield good crystalline salts with sulphuric, hydrochloric, oxalic, and acetic acids, but too small a quantity was obtained for analysis. Injected subcutaneously into rabbits it produced a rise in temperature as well as an increase of the pulse, 0·08 gram being a lethal dose, whilst the narcotic and intoxicating action of the lolium plant seems to be due to temulentic acid and the base obtained from it. The acid, which exists to the extent of about 1 per cent. in the seeds, is obtained in crystals melting at 234°C. and possessing the approximate composition $C^{12}H^{42}NO^{19}$, and as well as temulentine yields good crystalline salts. From experiments upon frogs, rabbits, and the investigator himself, it appears to be twice as toxic as loliine and rapidly diminishes the heart's action, but if the depression, which is accompanied by a marked decrease in temperature, is overcome, the patient assumes a condition of high fever. Dr. Antze recommends, in cases of poisoning with darnel grass, the administration of emetics and purges, followed by stimulants to raise the depressed action of the heart. (*Pharm. Journ.*, Jan. 31st, 1891.)

Toxicology.—The symptoms which darnel seeds produce on man are described by Pereira as twofold: "those indicating gastro-intestinal irritation, such as vomiting and colic; and those which arise from disorder of the cerebro-spinal system, such as headache, giddiness, languor, ringing in the ears, confusion of sight, dilated pupil, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. These seeds,

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therefore, appear to be acro-narcotic poisons. According to Seeger, one of the most certain signs of poisoning by them is trembling of the whole body." Death has sometimes resulted from their use, but when suitable remedies have been used, such as evacuants and stimulants, the seeds have not proved fatal to man. Recent experiments made by A. S. Wilson of Aberdeen conclusively proved that healthy darnel seeds have no injurious effects. In selecting healthy seeds, Mr. Wilson observed the grains to be frequently affected by ergot and other fungi, and to be also liable to a disease of a more obscure type.

From Dr. P. Antze's experiments it appears that there are two poisonous principles in the diseased seeds, one an acrid poison giving rise to a febrile condition, and the other a narcotic powerfully depressing the heart's action.

In the Report of the Chemical Examiner, N.-W. Provinces and Oudh, for 1879, the occurrence of darnel-poisoning among the men of the Ghoorkha Regiment at Almora, and also among some of his own servants at Nynee Tal, is recorded. He states that the grass is recognised as injurious by the peasantry in the Moozaffarnagar District, where it is called *Mochni*. The symptoms observed were vomiting, headache, and great giddiness; no fatal cases occurred.

BAMBUSA ARUNDINACEA, *Retz.*

Fig.—*Roxb. Cor. Pl. i., t.* 79; *Rheede, Hort. Mal. i., t.* 16. Bamboo (*Eng.*), Bambou (*Fr.*).

Hab.—Throughout India. The young shoots, seeds, and silicious concretion.

Vernacular.—Báns (*Hind., Beng.*), Vánsa (*Guz.*), Vánsa, Kalaka, Tokara (*Mar.*), Mangal (*Tam.*), Bonga, Veduru (*Tel.*), Bidungulu (*Can.*).

Bamboo Manna.—Báns-lochan (*Hind.*), Báns-kápúr (*Beng.*), Vánsa-lochana (*Mar.*), Vánsa-kápúra (*Guz.*), Munga-luppu (*Tam.*), Veduruppu (*Tel.*), Bidaruppu (*Can.*), Moleuppa (*Mal.*).

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History, Uses, &c.—The Bamboo, in Sanskrit Vansá and Vénu, is considered by the Hindus to have the hardest of woods. The word also signifies 'spine' and 'lineage,' thus Vánsa-visuddha means "made of a good bamboo," *i.e.*, of a pure or good family, and Vanśa-dhara "carrying a bamboo," *i.e.*, maintaining a family, Vansa-pratishthana-kara "establishing a family on a sure foundation." The Abbé Dubois, in his *Description of India*, states that the young Indian bride and bridegroom are made to stand in two bamboo baskets placed side by side, and the *Kul* or *Arbor generationis* of the caste, at Hindu marriages, is placed in a winnowing fan made of bamboo. The wild tribes of the Garrow hills, who have no temples or altars, set up opposite their huts a bamboo post which they deck with flowers and tufts of cotton, and before it they make offerings to their god. Indian anchorites carry a bamboo stick having seven knots. A bamboo flowering is an event of rare occurrence, and which is supposed to bring in its train all sorts of evil, accompanied by dire distress and famine. The seeds of the bamboo, in Sanskrit Vanśa-tandula, Vanśa-ja, Vénu-yava, Vénu-vija, have often proved of great value in famine seasons, saving thousands of lives; this was the case in Orissa in 1812 and in Canara in 1864. The young shoots which appear towards the end of the rainy season are used as a vegetable; they are minced very finely and soaked in water to remove the bitter taste, and then cooked with *dál*, and seasoned according to taste: they are also made into pickle.

A decoction of the joints of the bamboo is supposed to have an action on the uterus, and is used by females after delivery to cause a free flow of the lochial discharge. The same part of the plant pounded with water is applied to inflamed joints. The juice of the leaves with aromatics is given in hæmatemesis. The leaves are very commonly given to horses by syces as a remedy for coughs and colds.

Bamboo manna is the Vanśa-lochana of the Indian physicians; in the Nirghantás it bears many synonyms, such as Vanśa-rochana, Tvak-kshirá "bark-milk," Vanśa-karpura "bamboo camphor," Vanśa-śarkara "bamboo sugar," Vanśáhva

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"bamboo sacrifice," Súbhra, and Sita "white," &c. It is considered to be strengthening, tonic, cold, and sweet; to alleviate thirst, and to avert phthisis, fever, asthma, cough, biliousness, skin diseases, and Váyu (morbid affections of the windy humor). As an example of the way in which it is prescribed, the following formula for making the *Sitopaládi-churna* will be found in Sarangadhara:—Bamboo manna 8 parts, long pepper 4, cardamoms 2, cinnamon 1, sugar 16. Powder and mix. Dose about 60 grains, to be given with honey and *ghi* in phthisis and cachexia.

The belief in the strengthening properties of bamboo manna appears to have originated among the aboriginal tribes of India, as on the West Coast it is the first solid food which the Thana Kolis give their children. The same belief seems to have prevailed in Borneo, as Marco Polo relates that pieces of this substance were let in under the skin by the natives to make the body wound-proof.

We hold with Salmasins that bamboo manna was the substance known to the Greeks as σάκχαρ σάκχαρον, and described by them as a white, concreted or crystalline substance like common salt, because there was no kind of sugar prepared from the sugar-cane, answering to this description, known in India in the time of Dioscorides. The name Sarkara, which signifies "grit, pebbles, sand," was applied by Hindu writers at that time to several substances, *viz.*, *Guda* or molasses in a dry granular state, the only kind of cane-sugar then in use in India; *Yavása-śarkara*, the concrete manna of Alhagi; and *Vanśa śarkara*, the concretion found in the bamboo. The Sanskrit name Khanda was also applied to Guda, which is the substance known in the vernaculars as Gúr or Gúl, and is still the kind of sugar most used by the Hindus. Pale crystalline sugar, the *Chini* of the bazars, does not appear to have been known until some 400 years after the date of Dioscorides.

Under the name of Tabáshir, a corruption of the Sanskrit Tvak-kshira, bamboo manna was known to the early Arab travellers in the East; the port of Thana, on the West Coast of

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India, was famous for its Tabáshir in the time of Idrisi (1135) and supplied it to all marts. Ibn Sina describes Tabáshir as astringent and stomachic, useful in erysipelas and to allay thirst in bilious dyspepsia, cardiacal, and strengthening. As a local application it is used to relieve the heat and irritation caused by aphthous eruptions along with pounded rose leaves. Later Mahomedan writers upon the Materia Medica of the East have added nothing of importance to Ibn Sina's account of the drug. Flückiger (*Zur Geschichte des Tabaschir*, *Zeit. des allg. österr. Apoth. Ver.* Nr. 14 u. 15, 1887) mentions a list of Indian goods on which transit duty was levied at Aden in 1270; in it Tabáshir is mentioned together with tamarinds and camphor. He also draws attention to a remarkable connection between Tabáshir and ivory ashes, generally known by the name of *Spodium.* Idrisi, in the middle of the 12th century, points out that the latter was used to adulterate the former, while others of a different opinion assign a greater value to Spodium. Garcia d'Orta (*Colloquios* 51) mentions both Tabáshir and Spodium, which he considers to be Pompholyx or Turtia (white of zinc? calamine?), and states that in Persia and Arabia Tabáshir was generally paid for by its weight in silver ("o preço ordinario na Persia e Arabia é a peso de pruta"); he also describes black or grey Tabáshir, which was of less value and was obtained by burning the bamboo cane. Flückiger remarks that it is most likely that the name "Spodium da canna" was given to this black Tabáshir or perhaps to the ashes of the cane, and that it might be owing to this circumstance that in later times the name Spodium came to be applied to animal charcoal (bone-black). The idea of black seems not to have been connected with the original Greek name σποδος (ashes). Flückiger also draws attention to the Latin translation of a Persian *Karabádin* or Pharmacopœia by the Carmelite Friar P. Angelus, published in Paris in 1681, in which Tabáshir is spoken of as *pseudo-spodium, anti-spodium*, and *spodium-arabicum.* Rheede as well as Rumphius notice Tabáshir, but it does not appear to have attracted much attention in Europe until Dr. Patrick Russell drew the attention of the Royal Society to it, and induced

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James Louis Macie to make an analysis, which showed that it consisted principally of silica.

Further information on Tabáshir may be obtained from Prof. Flückiger's papers above mentioned, and a paper by Dr. Brandis in the *Indian Forester*, March, Vol. XIII.

Description.—Tabáshir consists of irregularly-shaped fragments of an opaque white or bluish opalescent colour. the larger pieces are about an inch in diameter, concavo-convex, and have evidently derived their form from the joint of the bamboo in which the deposit has collected. The raw article is blackened and dirty, having apparently been obtained by burning the bamboos, or on account of the presence of insects; to make it fit for use it is calcined, when it becomes perfectly clean.

Chemical composition.—Cavendish (*Ebenda*, 370) determined the specific gravity of Tabáshir to be 2·169 at 11·4°C.

Humboldt remembered the analysis of Macie when he and Bonpland discovered a similar substance at the volcano of Pichincha, not far from Quito. He wrote from Mexico on the 22nd of April 1803 to Antonio Joseph Cavanilles, Director of the Botanic Garden at Madrid (*Annales du Muséum*, iv. (An. xii., 1804), 478)—"Vous vous souvenez sans doute de cette substance siliceuse, ressemblante à l'opale que M. Macie analysa en Angleterre. Nous l'avons découverte à l'ouest du volcan Pichincha, dans les bambous ou gros roseaux appelés *Guaduas* dans le royaume de Santa Fé. J'ai fait des expériences chimiques sur le sue de cette graminée colossale, avant que la substance siliceuse se fût déposée, et j'y ai remarqué des phénomènes très-curieux; il est susceptible d'une putréfaction animale, et paraît annoncer une certaine combinaison d'une terre simple avec l'azote." The *Guaduas* are the representatives of the Indian bamboos in South America and closely related to them. The specimen of American Tabáshir which Humboldt sent to Paris was examined by Fourcroy and Vanquelin (*Ann. du Mus.*, vi. (1806), 382—385); they found, besides 70 per cent. of silicic acid, 30 per cent. of potash and lime. It would be interesting to know if it was perhaps a

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silicate, which seems possible, as they mention traces of crystallization. The remarkable optical properties of this amorphous silicic acid attracted the attention of Brewster (*Trans. Roy. Soc. London* (1819), i., 283—299), who found it to possess very little power of refracting light, and to show when heated in the dark a brilliant phosphorescence. The information concerning its physical properties given by Brewster was, however, partly contradicted, and, as it seems, with reason, by Guibourt in 1885. Edward Turner (*Ebenda*, pp. 335—338) found that the substance examined by Brewster could easily be dissolved in a solution of caustic potash, even after having been heated; the silicic acid separated from the solution, after being heated to redness, weighed nearly as much as the quantity of Tabáshir examined. The transparency which Tabáshir acquires when immersed in water was noticed by Brewster and Guibourt; this property is still more striking when it is immersed in a volatile oil or liquid paraffin, for then with very pure specimens the outlines are scarcely to be distinguished. Guibourt determined its sp. gr. in water to be 2·149 at 4°C., and found Indian Tabáshir to be composed of 97·39 per cent. of silicic acid, 2·9 per cent. water, with traces of potash and lime.

In 1859 Flückiger (*Schweizerische Zeitsch. f. Pharm.*, 1859, 244) examined a very fine specimen of Tabáshir from Java, where it is known by the name of *Batugining*, and found it to be almost pure silicic acid. It would appear, however, to be sometimes mixed or adulterated with the ashes of the cane, as Rost van Tonningen (*Jahresb. der Chem.*, 1860, 531) found a specimen to contain silicic acid 86·38, water 7·63, oxide of iron, potash, and lime 5·99 per cent.

The careful examination of Tabáshir made by Poleck (*Zeitsch. des österr. Apoth. Ver.*, 1887, p. 139) shows beyond doubt that it may be considered to be silicic acid, although the question remains open, whether it is the normal acid $Si(OH^4)$. (Flückiger, *Zur Geschichte des Tabaschir*, *Zeitsch. des allg. österr. Apoth. Ver.* Nr. 14 u. 15, 1887.) As regards the variations observed in the amount of water contained in this substance, the reader is referred to our remarks under *Commerce.*

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The ash of bamboo stems has been analysed by Hammerbacher with the following results: SiO^2, 28·264; CaO, 4·481; MgO, 6·569; K^2O, 34·217; Na^2O, 12·765; Cl, 2·062; SO^3, 10·705; Ferric phosphate, 0·037=99·100. The ash is rich in silica and alkalis, poor in alkaline earths. The proportion of alkalis is about the same as in the ashes of ordinary roots. (*Liebig's Annalen*, clxxvi., 87.)

Commerce.—Bombay appears to have inherited the ancient trade in Tábáshir which formerly centered in Thana. The raw article is, however, now obtained from Singapore, and is probably the produce of Java and other islands of the Eastern Archipelago. The Indian bamboos being under the protection of the Forest Department prevents their being destroyed to obtain Tabáshir, besides they are of much more value for other purposes. The Bombay trade in this article is now the monopoly of a Mahometan, who is the sole importer of the raw material, which he calcines and afterwards sells in bulk at Rs. 2-10 per lb. He also sells a selected quality at Rs. 4 per lb., and an inferior quality at Re. 1-4. The method of calcination is a trade secret. After it has been calcined, Tabáshir is placed in water, which it absorbs and increases greatly in weight, becoming cold to the touch; this fact is pointed out to the purchaser as a proof of its cooling qualities. The water is retained by the drug for a long time.

SACCHARUM OFFICINARUM, *Linn.*

Fig.—*Woodville, t.* 266; *Tussac, Fl. Antilles, i., tt.* 23—25; *Bentl. and Trim., t.* 298. Sugar-cane (*Eng.*), Canne à sucre (*Fr.*).

Hab.—India. Cultivated in all warm climates. The juice and root

Vernacular.—Úkh, Ganna (*Hind.*), Ák (*Beng.*), Ús (*Mar.*), Shéradi (*Guj.*), Karumbu (*Tam.*), Cheruku (*Tel.*), Karimpa (*Mal.*), Khabbu (*Can.*).

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History, Uses, &c.—If the wild form of the sugar-cane is to be anywhere now met with, it is in India, of which country it is undoubtedly a native, and where it has been cultivated from the earliest antiquity. Whether the species grown in China, *S. sinense* (Roxb.), is specifically the same is scarcely determined with certainty, but it is probably native in that country. (*Bentl. and Trim.*) The Sanskrit name of the plant is Ikshu, and it is also called Guda-trina, "the grass from which *guda* is made," and Guda-dáru, &c.; from the juice (Ikshurasa) the ancient Hindus prepared an extract by boiling, which, when soft and sticky, was called Ikshurasa-kvátha, Phánita, and Guda, but when allowed to drain and become dry was known as Guda-śarkará, Khanda or Khanda-sarkára, and Matoyandika. Twelve varieties of sugar-cane are mentioned by Sanskrit writers, but in this number are probably included other grasses belonging to the genera *Saccharum*, *Sorghum*, &c. The root of the sugar-cane is also used in Hindu medicine, and is considered to have demulcent and diuretic properties. It is an ingredient along with the roots of *Saccharum sara*, *S. spontaneum*, *Eragrostis cynosuroides*, and *Cynodon dactylon* in the compounds known as *Trinapancha-mula* and *Kuśa-valeha*, which are much prescribed as adjuncts to metallic medicines in gonorrhœa and other affections of the urinary passages. A kind of rum was also obtained by the ancient Hindus from the juice of the cane or from *guda* and water fermented, which was known as Sidhu and Ganda.

The unrefined, dark-brown Guda or Phánita of the Hindus was known to the ancient Persians as پانیذ (Pániz) and شکر (Shakar); from it they manufactured the dry crystalline sugar which they call کند (Kand) or نبات (Nabát), now generally written قند by both Arabs and Persians. We have already stated (see Article on Bambusa) our reasons for believing that the σάκχαρον of Dioscorides was not cane-sugar, *viz.*, that no such article as sugar in a dry crystalline state was known in India at that time, the only kind of sugar used by the Hindus being the dark-brown mass known as *guda*, and which is still the kind of sugar most popular in India. This substance, as well

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as the *guda* prepared from the palm (φοίνιξ), was called by the Greeks μέλι (honey), and is mentioned by Herodotus, Theophrastus, Seneca, Strabo, and other early writers as "Honey of Canes" and "Honey made by human hands." The vernacular names Misri, "Egyptian," for refined sugar, and Chini, "Chinese," for sugar-candy, point to these crystalline forms of sugar as comparatively recent introductions into India, and at the present time the sugar-candy of Indian commerce is chiefly imported from China. When we consider that the sugar-cane was known to the ancients from the time of Nearchus, it is hardly reasonable to suppose that Pliny could be so ill-informed as to speak of Saccharum, if by that name he meant cane-sugar, as only employed in medicine. Lucan, writing about the same time, was aware that the Hindus drank the juice of the cane:

"Quique bibunt tenera dulces ab arundine succos."

At the present day, the cane-presser, with his primitive press, is a familiar personage at Indian fairs, where he dispenses the luscious juice to his customers at about twopence a pint.

Sugar, under the name of Shi-mi "stone honey," is frequently mentioned in the ancient Chinese annals among the productions of India and Persia; and it is recorded that the Emperor Tai-tsung (A.D. 626—650) sent an envoy to the kingdom of Magadha in India, to learn the method of manufacturing it. (*Bretschneider*, *Chinese Botanical Works*, 1870, 46.) The Chinese acknowledge that the Indians between A.D. 766 and 780 were their first teachers in the art of making sugar. An Arabian writer, Abu Zaid-el-Hasan, states that about A.D. 850 the sugar-cane was growing on the north-eastern shore of the Persian Gulf; and in the following century, the traveller Ali Istakhri found sugar abundantly produced in the Persian Province of Kuzistan. About the same time (950) Moses Chorenensis stated that the manufacture of sugar was flourishing near the celebrated school of medicine at Jondisabur in the same province, and remains of this

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industry in the shape of millstones, &c., still exist near Ahwas.

Persian and Arabian physicians of the 10th and 11th centuries, such as Rázi, Ali Abbás, and Ibn Sina, introduced sugar (سكر Sukkar) into medicine. The Arabs cultivated the cane in many of their Mediterranean settlements, as Cyprus, Sicily, Italy, Northern Africa, and Spain. The Calendar of Cordova shows that as early as A.D. 961 the cultivation was well understood in Spain, which is now the only country in Europe where sugar-mills still exist.

The importance of the sugar manufacture in the East was witnessed by Marco Polo, Barbosa, and other European travellers; and the trading nations of Europe rapidly spread the cultivation of the cane over all the countries of which the climate was suitable. The ancient cultivation in Egypt, probably never quite extinct, was revised on an extensive scale by the Khedive Ismail Pasha. (*Pharmacographia.*)

Sugar is of comparatively little value for its independent effects, but few substances are more useful as an associate of other medicines, whether to preserve them from oxidation and decomposition, to conceal or improve their taste, or to give them special pharmaceutical forms.

In solution sugar is almost exclusively lenitive, but in powder it is stimulant. It is universally employed to diminish dryness of the mouth and fauces, to allay irritation, and to mitigate cough and hoarseness. Sugar dissolved in water is said to have a diuretic effect. When injected into the veins of animals it is said to be powerfully diuretic (Richet and M. Martin, *Med. Record,* xxi., 394). It certainly, when moderately used, promotes digestion and allays nervous excitement. For these purposes sweetened water (*eau sucrée*) is universally employed in France and Southern Europe. Formerly a strong solution of sugar was much used as an antidote to corrosive poisons. It enters into all the drinks, mucilaginous, farinaceous, and gelatinous, employed in febrile diseases. Finely-powdered sugar will sometimes relieve the hiccough, which, in

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nursing infants, is apt to arise from over-feeding. Loaf-sugar, eaten freely, is said to arrest the development of alcoholic intoxication, perhaps by retarding gastric absorption. A strong solution of sugar injected into the rectum has been used successfully to destroy ascarides of that part. In powder it is very efficient as a remedy for aphthæ of the mouth, in repressing the exuberant and stimulating the indolent granulations of ulcers, in removing opacities of the cornea, and in curing granular eyelids. Sugar has been claimed by Fischer to be an efficient antiseptic dressing for wounds. He associated it, however, with other antiseptics; but Windelschmidt states that for small wounds sugar is equal to iodoform as a dressing (*Med. News*, xliii., 462). In chronic laryngitis, when inhaled by a sudden aspiration from a tube extending to the root of the tongue, it may be used with advantage alone or mixed with other powders. In the same manner it may be employed as a snuff in chronic ozæna. The fumes from burnt sugar destroy offensive effluvia, and are conveniently disengaged by sprinkling sugar upon burning coals or on a hot shovel. (*Stillé and Maisch.*) We have already referred to the use of sweetmeats by opium-eaters to counteract the effects of the drug (p. 96, Vol. I.).

Cultivation.—The sugar-cane season comprises nearly a twelvemonth. The land chosen is usually a good loam or light clay manured. The leafy ends of the preceding season's canes are cut off, or the whole cane is chopped into pieces so as in any case to include two nodes or joints, and these, to the number of about 20,000 per acre, are planted in furrows in January and February. The land is irrigated occasionally from this time to the commencement of the rains. The harvest begins in the beginning of December, and the cutting and crushing of the canes and boiling of the juice is carried on till January and February. Excepting the few mills under European management, the crushing and boiling is performed by primitive, and, therefore, rude processes. The average outturn per cent. of cane in the North-West Provinces is stated by Messrs. Duthie and Fuller to be as follows: 100 of canes=15

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of juice=18 of *guda* (unrefined sugar) or 17·5 of *shakar* * (dry, unrefined sugar), or 19·5 of *ráb* (syrupy sugar). The natives generally manufacture the juice into the two kinds of *guda*, called in the vernaculars *gúra* or *gúla*.

Description.—The transverse section of a sugar-cane exhibits numerous fibro-vascular bundles, scattered through the tissue, as in other monocotyledonous stems; these bundles are most abundant towards the exterior, where they form a dense ring covered with a thin epidermis, which is very hard from the quantity of silica deposited in it. In the centre of the stem the vascular bundles are few in number, and traverse an abundant parenchyma which contains in its thin-walled cells an almost clear solution of sugar, with a few small starch granules and a little soluble albuminous matter. The latter is found in larger quantity in the cambial portion of the vascular bundles. The walls of the medullary cells contain pectic matter, but not in sufficient quantity to cause them to swell much in water. (*Wiesner.*) The unrefined sugar of India (gúra or gula), often incorrectly termed molasses, occurs in two forms in the bazars—one is a blackish sticky mass without evident crystalline structure, the other is a dark-brown partly crystalline mass which crumbles on pressure, and is generally spoken of by the dealers as floury *gúr* or *gúl*—the first contains the whole of the uncrystallizable portion of the syrup, in the other most of this has been drained off. Indian molasses or treacle is of a very dark colour, of a peculiar sharp flavour, and has a bitterish after-taste caused by the presence in it of caramel or burnt sugar, produced during the careless evaporation of the cane juice. It is hardly suited for pharmaceutical purposes, and as sold in the bazars is generally freely watered and in a state of fermentation. The refined sugars of Indian commerce are manufactured on the European system, chiefly in Bengal, or are imported from Mauritius, and,

* Called by Europeans *Jaggery*, a corruption of the Sanskrit Sarkara, which in Ceylon is the vernacular name for unrefined sugar in the corrupted form of Shakkare.

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in the case of loaf-sugar, from France. They differ in no respect from the sugars of European commerce.

Chemical composition.—The sugar-cane is, when mature, composed of cellulose 8 to 12 per cent.; sugar 18 to 21; water, including albuminous matter and salts, 67 to 73. Of the entire quantity of juice in the cane, from 70 to 84 per cent. can be extracted by crushing and pressing, and yields in a crystalline state about three-fifths of the sugar which the cane originally contained. The juice has on an average the following composition :—

Albuminous matters	0·03
Granular matter (starch ?)	0·10
Mucilage containing nitrogen	0·22
Salts, mostly of organic acids	0·29
Sugar	18·36
Water	81·00
	100·00

There is also present in the juice a very small amount of a slightly aromatic substance (essential oil ?) to which the crude cane-sugar owes a peculiar odour which is not observed in sugar from other sources. (*Pharmacographia.*) Sugar, $C^{12}H^{22}O^{11}$, may be obtained in large transparent rhombic prisms, known as *sugar-candy*, which does not differ from lump-sugar, except that the latter is in crystalline masses from disturbed crystallization. Sugar has the specific gravity 1·58 (*Kopp*), is permanent in the air, neutral, without odour, has a very sweet taste, and dissolves at ordinary temperatures in one-half its weight of water, yielding a dense, sweet, and colourless liquid known as syrup; saturated at 15° C. such a solution contains 66 per cent. of sugar, and this has the density 1·345082 (*Michel and Kraft*). At the boiling-point sugar dissolves in water almost in all proportions. It requires

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for solution about 80 parts of boiling absolute alcohol, 28 parts of boiling officinal alcohol, and about 4 parts of boiling alcohol, spec. grav. ·830, these solutions depositing most of the sugar on cooling. The solubility is greater in weak alcohol, both cold and hot. At 15° C. 1 part of sugar dissolves in 2 parts of 50 per cent. alcohol, in 7·7 parts of 75 per cent. alcohol, in 14·7 parts of 80 per cent. alcohol, in 31·6 parts of 85 per cent. alcohol, in 175 parts of 92 per cent. alcohol, and in 228 parts of methylic alcohol of the same strength (*Casamajor*). Sugar dissolves also in glycerin, the solubility being increased on dilution with water, but it is insoluble in ether, chloroform, carbon disulphide, and in hydrocarbons. It combines with chloride of sodium, yielding deliquescent crystals which contain 14·9 per cent. of that salt. Definite compounds have likewise been obtained with several other salts and with alkalies and alkaline earths. When triturated in the dark it becomes luminous. Its solution deviates polarized light to the right—a behaviour which is of great practical importance for the estimation of sugar in aqueous liquids and for distinguishing different kinds of sugar which have a different rotary power.

When sugar is heated to 160° C. it melts without losing in weight, and congeals on cooling to a transparent amorphous yellowish mass known as *barley-sugar*, *saccharum hordeatum*, which becomes gradually opaque on the surface from the formation of minute crystals. If sugar is kept in the melted state between 160° and 170° C. for a short time, it is converted into a deliquescent mixture of *glucose* and *levulosan*; $C^{12}H^{22}O^{11}$ yields $C^6H^{12}O^6 + C^6H^{10}O^5$; the latter is not fermentable until after it has been boiled with water or dilute acids. When heated to between 180° and 200° C. sugar turns brown, evolves a peculiar odour, and is converted into *caramel*, $C^{12}H^{18}O^9$, parting at the same time with $2H^2O$; the pure product of this composition, *caramelan*, was obtained colourless by Gélis (1862). Caramel may be prepared in the same manner from inferior qualities of sugar, from molasses, and from glucose, and the conversion is hastened in the presence of small quantities of alkalies; the addition of a little carbonate of ammonium, which

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is again volatilized by the heat, is of service, for the reason stated. Subjected to dry distillation, sugar yields aldehyd, acetone, acetic acid, tarry products, and carbonic acid, carbonic oxide, and marsh gas. According to Lassaigne, iodine heated with solution of sugar is converted into hydriodic acid. Under the influence of ferments, as well as of dilute acids, cane-sugar is converted into *invert-sugar*, which is a mixture of *dextrose* or grape-sugar and *levulose* or fruit-sugar, and is directly fermentable. This inversion of sugar takes place slowly on boiling with water, but cold aqueous solutions keep unaltered for a long time, provided the access of ferments suspended in the air be prevented. Under the same condition, according to the investigations of Kreusler, Lemoine, and others, light does not exert the inverting effect reported by Raoul (1871). Nitric acid inverts cane-sugar, readily, and when heated with it produces saccharic, racemic, tartaric, and oxalic acids.

Tests.—The purity of cane-sugar is ascertained by the physical properties described above and by its complete solubility in water and alcohol. The absence of glucose or of a similar sugar is ascertained by some of the reactions given below. "Aqueous and alcoholic solutions of sugar should have no effect on litmus-paper. The solution in 20 parts of distilled water should be scarcely rendered turbid by silver nitrate or barium nitrate (chloride and sulphate)." Neither an aqueous nor an alcoholic solution of sugar kept in large, well-closed, and completely-filled bottles should deposit a sediment on prolonged standing (absence of insoluble salts, foreign matters, ultramarine, Prussian blue, &c.). If a portion of about 1 Gm. of sugar be dissolved in 10 cm. of boiling water, then mixed with 4 or 5 drops of test solution of nitrate of silver and about 2 cm. of water of ammonia, and quickly heated until the liquid begins to boil, not more than a slight coloration, but no black precipitate should appear in the liquid after standing at rest for 5 minutes (absence of grape-sugar and of more than a slight amount of inverted sugar). (*Stillé and Maisch.*)

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Commerce.—The following statistics of the trade in Sugar are taken from the Reports on the inland trade of the different provinces and on the trade by sea:—

ARTICLES.	Value in lakhs of Rupees. 1888-89.	1887-88.	1886-87.	1885-86.	Quantity in thousands of cwts. 1888-89.	1887-88.	1886-87.	1885-86.	Weight.
Sugar, refined ...	10	4	4	3	144	38	33	25	cwts.
Do. unrefined.	45	42	46	50	869	1,009	953	1,143	,,
Total ...	55	46	50	53	1,013	1,047	986	1,168	cwts.
Sugar, refined...	...	18	20	21	...	150	158	163	cwts.

ORYZA SATIVA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 291; *Rheede*, *Hort. Mal. v.*, 196—201. Rice (*Eng.*), Riz (*Fr.*).

Hab.—Throughout India, wild and cultivated. The grain, spirit, and vinegar.

Vernacular.—Dhán (*Hind.*, *Beng.*), Bhát (*Mar.*), Chokha (*Guz.*), Arishi (*Tam.*), Biyyam (*Tel.*), Akki (*Can.*).

Husked Rice.—Chával (*Hind.*, *Beng.*), Tándula (*Mar.*).

History, Uses, &c.—Wild rice was probably used by the aboriginal tribes of India in prehistoric times; it is still carefully collected by the peasantry, who consider it to have special virtues, and call it "god's rice," "hermit's rice," &c. Rice (व्रीहि vríhe) is not mentioned in the *Rig-Veda*, but in the *Atharva-Veda* it is noticed along with barley, másha (*Phaseolus Roxburghii*), and sesamum. Rice cultivation in India appears to have been subsequent to that of China and Burma. Girard de Rialle, in his *Mythologie comparée*, states that the Karens of Burma believe that every plant has its *là* or *kelah* (spirit). The rice has its spirit, and when the crop is bad, they pray to it

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in the following terms: "Come, O spirit of the rice, come back! come to the rice-field, come to the rice! come from the East, come from the West, come from the beak of the bird, from the mouth of the monkey, from the throat of the elephant, come from the grain stores! O *kelah* of the rice, return to the rice!" In Siam they offer rice and cakes to trees before cutting them down. In Bengal sacrifices of rice are made to the Bael tree, probably a survival of an ancient fetish worship which the Brahmins have sanctioned by deifying the tree.

Rice plays an important part in the marriage ceremonies of the Hindus. According to the Grihya-sutra of Asvalayana, the bride must walk three times round the altar, and at the completion of each turn make an offering of rice. This ceremony resembles an ancient form of marrying among the Romans, in which an offering of a cake made of *fár* (spelt)* was made in the presence of the Pontifex Maximus or Flamen Dialis and ten witnesses.

Parched rice, *Lájá*, also called *Syálá* (*Sya* "a winnowing fan," and *lá* for *lájá*), is scattered by the bride's brother at marriages. Rice is poured over the head of the bride and bridegroom as an emblem of life, regeneration and plenty. On the fourth day of the marriage ceremonies the young couple eat rice together for the first and only time in their lives, and on the last day they both celebrate together the Soma sacrifice, when they throw *lájá* into the fire. At the birth of a child the father places the red Akshata rice on its forehead to avert evil, and when the child is named it is placed on a cloth covered with rice. Rice is also used in some parts of India to detect witches: a small bag of rice, bearing the name of each of the suspected parties, is placed in a white-ants' nest, and the one they first eat is considered to belong to the guilty party. When several persons are suspected of a crime, rice is sometimes used to detect the guilty one— For this purpose the persons are required to chew rice, the criminal being discovered by his inability to properly masticate

* *Triticum Spelta*, Linn., or German wheat.

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it, owing probably to fear checking the free flow of saliva. Vincenzo Maria da Santa Caterina mentions in his travels that rice and turmeric are offered in India to the gods to obtain children and the cure of female diseases, and that young girls make a vow to offer rice, should they obtain a good husband. In the consecration of the Brahmachari, the father of the youth carries in his hands a cupful of rice, and the assistants after the bath cover the candidate with rice. Asvalayana says that the disciple asks alms to learn the Vedás; he obtains the rice as alms and must cook it before sunset. His commentator, Narayana, adds that when the rice has been cooked, the disciple should say to his master, "the food of the pot is ready." In sacrifices to Rudra, according to Asvalayana, the husk of rice was thrown into the fire along with the smallest grains, and the tail, skin, head, and feet of the animal, and that the latter before being killed was sprinkled with rice and barley-water.

In times of fasting and penitence, grains of rice and barley are watered and blessed and offered to the gods. In funeral ceremonies rice and other food is offered to crows. According to Manu, the twice-born are directed to offer five great sacrifices, *viz.*, with wild rice (Nivára), with various pure substances, or with herbs, roots, and fruits.

The practice of worshipping the new rice at the time of the harvest is common throughout India. In Bengal, on a Thursday, in the month of Pansha (December-January), after the crop has been reaped, a rattan-made grain measure called *rek*, filled with the grain upon which are placed gold, silver and copper coins and some cowrie shells, is worshipped as the representative of the goddess of fortune. This worship is repeated in the months of Chaitra, Sravana, and Kártika. In Western India the new rice is worshipped at the Dasara and Devali festivals, and in Madras the same event is celebrated by the *Pongol* ceremony, when the new rice is boiled for the first time and eaten with great rejoicings. Among the Native Catholics the same ceremony is perpetuated in the "blessing of the new rice," which is done by the priest in the field before the crop is cut.

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That the cultivation of rice had widely spread in the time of Alexander (400 B.C.) we learn from Strabo, who says, "according to Aristobulus, rice grows in Bactriana, Babylonia, Susida," and he adds, "we may also say in Lower Syria." Further on he notes that the Indians use it for food, and extract a spirit from it. The Greek names for rice are derived from the Sanskrit *Vrihi;* the earliest form occurs in a fragment of Sophocles, where rice-bread is called ὀρίνδης ἄρτος; in later writers we meet with the form ὄρυζα. The Arabic names have the same derivation, the oldest form being Runz, occurring in the local dialect of the Abd-el-Kais, near Bahrain, and the more modern forms Aruzz and Ruzz. In Persian the form of Birinj is current, as well as the Sanskrit name Shâli, for unhusked rice. Dioscorides briefly mentions rice as being of little nutritive value and apt to cause costiveness. Celsus (ii., 20) classes it along with wheat and spelt as "res boni succi." According to Sanskrit writers, the best class of grains includes wheat, rice, and barley only, other kinds being relegated to the class *Kshudra dhánya* or inferior grains. The preparations of rice used in the diet of sick people, and described in Sanskrit medical works, are:—

यवागु (yavágu) or powdered rice boiled with water. It is made of three strengths, namely, with nine, eleven, and nineteen parts of water, called, respectively, *Vilepi, Peyá,* and *Manda.* Instead of water, a light decoction of some aromatic and carminative drug, such as ginger or pepper, may be used in preparing *yavágu.*

लाजा (lájá) or unhusked rice parched in hot sand. It is used as light and digestible diet for the sick.

भृष्टतण्डुल (brishta tandula) or husked rice parched in hot sand. It is used for the same purposes as *lájá.*

पृथुका (prithuká) or unhusked rice moistened, parched, and afterwards flattened and the husk removed. It is soaked in water or boiled and given with curdled milk as an astringent diet in diarrhœa or dysentery.

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पायस (páyasa) or rice-milk. A well-known preparation.

तण्डुलाम्बु (tandulámbu) or water in which unboiled rice has been steeped. This is often used as a vehicle for powders, &c., and as a diet drink.

Rice is the staple-food of the inhabitants in Bengal, many parts of Madras, Burma, and the Western Coast of India, but not of the central and northern parts of the country, where wheat and millet are the staples and rice only a luxury.

Fermented and distilled rice liquors are largely used in many parts of India. For an account of the economic uses of the grain, its cultivation, and the numerous varieties of the plant met with in different parts of the country, we must refer the reader to a diffuse but interesting article by Dr. G. Watt in the *Dictionary of the Econ. Prod. of India.*

Chemical composition.—Rice has been examined by Letheby, Payen, and others. Payen gives the percentage composition of dried rice, as, nitrogenous matter 7·55, carbohydrates 90·75, fat 0·8, and mineral matter 0·9. In chemical composition rice closely resembles the potato; one hundred parts of dried potato, according to Letheby's analysis, contain, nitrogenous matter 8·4, carbohydrates 88, fat 0·8, and saline matters 2·8 parts per cent.

Church (*Food Grains of India*) gives the following percentage composition of cleaned rice:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6. Professor Church remarks, 100 parts of rice contain no more than ·065 of potash and ·284 of phosphoric acid. König quotes 20 analyses of rice by various chemists, the mean percentage composition being, water 13·11, albuminoids 7·85, fat ·88, nitrogen-free extract and starch 76·52, cellulose ·63, ash 1·01. Where rice constitutes almost the entire food of the population, the throwing away the water in which it has been boiled involves the loss of some of the mineral matter, and is to be deprecated; no more water should be used in cooking this grain than can be absorbed by it. Two pounds of cleaned rice weigh 5 pounds after boiling.

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Commerce.—The following table shows the exports of Rice (husked) from India during the last ten years in thousands of cwts :—

Year.	Burma.	Bengal.	Madras.	Bombay.	Sind.	Total.	Value in lakhs of Rupees.
1880-81......	16,730	6,717	2,363	927	32	26,769	89,717
1881-82......	16,690	7,617	1,549	614	49	28,519	82,496
1882-83......	21,249	7,838	1,319	552	71	31,029	84,401
1883-84......	16,994	7,394	1,843	521	80	26,832	83,289
1884-85......	13,507	6,035	1,403	677	80	21,702	71,228
1885-86......	19,084	6,879	1,181	521	149	27,814	91,672
1886-87......	18,216	5,902	1,564	639	139	26,460	87,648
1887-88......	17,879	7,996	1,438	764	72	28,149	92,251
1888-89......	14,205	6,417	1,538	589	19	22,768	78,453
1889-90......	18,259	5,992	1,654	799	70	26,774	100,473
Average for 10 years...	17,491	6,878	1,585	660	76	26,681	86,162

The estimated total production of rice in 1888-89 has been given as :—

Bengal	14,269,223	tons.
Madras	2,693,916	,,
Bombay and Sind	399,757	,,
N.-W. Provinces and Oudh ..	2,420,768	,,
Punjab	271,293	,,
Central Provinces..............	1,622,385	,,
Burma	3,039,397	,,
Assam..........................	608,846	,,
	25,325,585	tons.

In the same year India imported from beyond its frontier 1,151,450 cwts., the greater portion coming from Nepaul. Of the exports, about 50 per cent. goes to Europe, 30 per cent. to Eastern ports, and the remainder for the use of the emigrants in Mauritius, Rèunion, the West Indies, South America, and

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Australia. The fine rice of the West Indies is considered insipid by the Indian labourers.

TRITICUM SATIVUM, *Lam.*

Fig.—*Bentl. and Trim., t.* 294. Wheat (*Eng.*), Blé (*Fr.*).

Hab.—The Euphrates region. Cultivated in N.-W. India, the Central Provinces, and Bombay.

Vernacular.—Géhun (*Hind.*), Gahun (*Mar.*), Godumai (*Tam.*), Godumulu (*Tel.*), Kotanpam (*Mal.*), Godhi (*Can.*), Gam (*Beng.*), Ghavum (*Guz.*).

History, Uses, &c.—Wheat, as the most important of the cereals, has given rise to numerous myths, for an account of which we cannot do better than refer the reader to the late Dr. W. Mannhardt's learned monograph *Die Komendämonen* (Berlin, 1868). In the myth of Persephone-kora, daughter of Zeus, the god of the heavens, which by their warmth and rain produce fertility, and of Dimeter or Ceres, the maternal goddess of the fertile earth, we perceive that she was conceived as a divine personification of this grain, in summer appearing beside her mother in the light of the upper world, but in the autumn disappearing, and in winter passing her time, like the seed under the earth, with the god of the lower world. As a pendant to the Greek myth, we have the Indian myth of Sita or "the Furrow," husbandry personified, and apparently once worshipped as a kind of goddess. In the *Rig-Veda* Sita is invoked as a deity presiding over Agriculture, and appears to be associated with Indra. In the *Vájasaneya*, Sita "the Furrow" is personified and addressed, four furrows being required to be drawn at the ceremony when certain stanzas are recited. Sita is so named because she was fabled to have sprung from a furrow made by her father Janaka while ploughing the ground to prepare it for a sacrifice instituted by him to obtain progeny, whence her epithet Ayonija "not womb-born."* Wheat was used in sacrifice by the Greeks and

* Of course, these myths are more or less applicable to all food-grains.

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Romans, and by the Hindus in Vedic times, as an emblem of fertility; it was poured upon the bride at the marriage ceremony, and in Northern India, wheat, millet and rice are still used on such occasions. Wheat, as the most important food-grain, is frequently mentioned by Hippocrates, who calls it πυρός, and mentions three kinds; Pliny also describes several kinds of *Triticum*. Sanskrit medical writers also mention three kinds of wheat, namely, Mahágodhuma or large-grained, Madhuli or small-grained, and Nihsuki or beardless; they consider it to be the most nutritive of the food-grains, but not so easily digested as rice.

Many varieties of wheat are cultivated in India, and through careless cultivation there is much mixture in the samples brought to market. A number of samples purchased by one of us in the Bombay market and sent to Australia for trial, were, on careful cultivation, found to be all mixed, some of them producing five or six distinct varieties. Indian wheats may be divided roughly into two classes, soft and hard, the former being mostly used for bread-making, and the latter for making a kind of vermicelli and certain other preparations used by the natives. Amongst the Hindus, owing to caste distinctions, the whole process of grinding the corn, separating the flour and making it into cakes, is usually performed by the women of the house, consequently the demand for ready-made flour is limited to the supply of the non-Hindu population, and some of the less particular Hindu castes. In the Indian process of making flour, the wheat, after cleaning, is placed upon a table and thoroughly wetted and the water allowed to drain from it during the night. The next morning, the still moist grain is ground in handmills by women. It is then sifted, and as much fine flour and *rawa* or *sují* (the heart of the grain) as can be obtained are laid aside. The remainder termed "*naka*" is again ground in a more powerful mill and an inferior kind of *rawa* obtained from it. The residue after a third grinding yields a coarse flour and bran. The bazar-made bread is of two kinds, that used by the Mahometans and known as *Nán*, which is in thin cakes, and loaf-bread introduced by the

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Portuguese. The former is similar to the bread used in all Mahometan countries, the latter is made with 60 parts fine *rawa*, 20 second sort or *naka rawa*, and 20 of first sort flour. A second or inferior kind of bread is also sold. The barm or yeast in use is, where obtainable, the fermenting juice of the palm, elsewhere an artificial barm is prepared.

In some of the large towns a loaf-bread is now made by Brahmins for the use of the Hindu population, but its use is very limited. In Calcutta, Madras, and Bombay, flour and bread made as in Europe is obtainable, and is gradually taking the place of the Portuguese article. Fine flour is also imported from Europe and America, as the excessive proportion of gluten in Indian flour renders it unsuitable for use in making pastry.

Wheaten flour is often used as a dusting-powder to allay the heat and pain of local inflammations, such as burns, scalds, &c., but it is inferior for such purposes to powdered starch. In America an uncooked paste made of the flour has been used with success in diarrhœa. In India flour is much used by the natives for making poultices.

Description.—The albumen which constitutes the main portion of the grain is composed of large thin-walled parenchyme, the cells of which on transverse section are seen to radiate from the furrow, and to be lengthened in that direction rather than longitudinally. In the vicinity of the furrow alone the tissue of the albumen is narrower. Its predominating large cells show a polygonal or oval outline, whilst the outer layer is built up of two, three or four rows of thick-walled, coherent, nearly cubic gluten-cells. This layer, about 70 mkm. thick, is coated with an extremely thin brown tegument, to which succeeds a layer about 30 mkm. thick, of densely packed, tabular, greyish or yellowish cells of very small size; this proper coat of the fruit in the furrow is of rather spongy appearance.

The gluten-cells, varying considerably in the different cereal grains, afford characters enough to distinguish them with certainty. In wheat, for instance, the gluten-cells are in a

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single row, in rice they form a double or single row, but its cells are transversely lengthened.

The layer alluded to as being composed of *gluten-cells* is loaded with extremely small granules of albuminous matters (gluten), which on addition of iodine are coloured intensely yellow. These granules, which, considering barley as an article of food, are of prominent value, are not confined to the gluten-cells, but the neighbouring starch-cells also contain a small amount of them: and in the narrow zone of denser tissue projecting from the furrow into the albumen, protein principles are equally deposited, as shown by the yellow coloration which iodine produces.

The gluten-cells, the *membrane embroynnaire* of Mège-Mouriès, contain also, according to the researches on bread made by this chemist (1856), *Cerealin*, an albuminous principle soluble in water, which causes the transformation of starch into dextrin, sugar, and lactic acid. In the husks (*épiderme, épicarpe,* and *endocarpe*) of wheat, Mège-Mouriès found some volatile oil and a yellow extractive matter, to which, together with the cerealin, is due the acidity of bread made with the flour containing the bran.

Chemical composition.—König quotes 200 analyses of wheat from different sources and by various chemists, and the following figures represent the minimum, maximum, and mean composition:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extractive.	Cellulose.	Ash.
Minimum ..	5·33	7·61	1·00	59·90	1·24	·52
Maximum .	19·10	21·37	3·57	73·77	6·34	2·68
Mean	13·65	12·35	1·75	67·91	2·53	1·81

According to Church (*Food Grains of India*), average Indian wheat has the following percentage composition:—Water 12·5, albuminoids 13·5, starch 68·4, oil 1·2, fibre 2·7, ash 1·7. The albuminoids in some samples examined were as high as 16·7. In English and American wheat they range from 8 to 9 per cent. only. The amount of starch varies between 60 and 70 per cent., and the weight of

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nitrogen between 1·6 and 2·7 per cent. A small quantity of saccharine matter is also present, and the ash contains nearly 50 per cent. of phosphoric acid. The inorganic constituents are mostly found in the bran, to the extent of over 7 per cent., while the nitrogenated principles enter chiefly the flour. If the latter be kneaded with cold water as long as the liquid becomes milky, a yellowish gray elastic and glutinous mass remains, which is the *gluten* of Beccaria, retains about 70 per cent. of water, and consists, according to Von Bibra, in the dry state, of about 70 per cent. *vegetable fibrin*, 3·8 to 9·3 *vegetable casein*, 7·5 to 19·5 *glutin*, and 4·6 to 8·2 per cent. of fat. When fresh it dissolves in dilute phosphoric acid and in solution of potassa. On drying it assumes a hornlike appearance and partly loses its solubility. According to Boussingault, it contains 15 per cent. of nitrogen.

To purify it, Ritthausen (1862-67) dissolves it in cold very dilute potassa solution (1 to 1,000 parts of water), decants from the undissolved starch, and precipitates with acetic acid. The precipitate is repeatedly treated with fresh portions of alcohol, commencing with spec. gr. ·914, and increasing the strength finally to absolute alcohol. After another washing with ether, the insoluble portion constitutes *gluten-casein*, which is slightly soluble in acetic acid, freely soluble in potassa, and becomes insoluble by heat. On evaporating the united alcoholic liquids to one-half and cooling, *gluten-fibrin* is separated, which is freed from adhering casein by dissolving it repeatedly in 60 and 70 per cent. alcohol. It is freely soluble in dilute acetic acid, and when boiled with water, in which it is insoluble, it is converted into a jelly. After the separation of gluten-fibrin, the greater portion of the alcohol is evaporated; the precipitate appearing on cooling is treated with a little alcohol, washed with ether, dissolved in a little 65 per cent. alcohol, and precipitated by absolute alcohol. The precipitate is *mucedin*; the solution contains *glutin* or *gliadin*. The former yields with cold or boiling water a milk-like liquid; the latter is soluble in water, alcohol, acetic acid, potassa, &c., the aqueous solution being precipitated by the salts of the heavier

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metals; glutin contains sulphur and 18 per cent. of nitrogen. These principles are the most important ones of the *vegetable protein compounds.* (*Stillé and Maisch.*)

Starch forms a white, inodorous, and tasteless powder, with a peculiar slippery feel between the fingers. Exposed to the atmosphere, it contains from 10 to 13 per cent. of moisture, which is given off at 100° C. (212° F.), and is reabsorbed on exposure. The spec. grav. of starch is about 1·5, but after complete drying is increased to 1·56. It is insoluble in ether, alcohol, and cold water; the last-mentioned liquid, however, when triturated with starch, so that some of the granules are ruptured, evidently dissolves a little, since it acquires, after filtration, a blue color on the addition of iodine. *Soluble starch* is obtained, according to Maschke, by the prolonged heating of starch to 100° C. (212° F.). When heated to between 160° and 200° C. (320° and 392° F.), it is gradually converted into *dextrin* (see below). Starch becomes soluble in cold water in the presence of the chlorides of zinc and of calcium and of other deliquescent or freely soluble salts. Its solution in hot water gelatinizes on cooling, the jelly of wheat starch being milk-white—that of potato starch, particularly when made with much water, being more translucent. On heating starch with glycerin a solution is obtained, which, according to Zulkowski (1875, 1880), contains soluble starch, obtainable by diluting with water and precipitating the clear filtrate with alcohol. Potato starch is easily converted into the soluble form, but wheat starch requires a prolonged heating, and rice starch is thus changed with still greater difficulty.

Preparation.—Wheat or other grain is soaked in warm water, to which sometimes an alkali is added, until the outer coating has become soft; it is then ground under water, and washed upon suitable sieves with pure water, with which the starch passes through and is collected by subsidence in suitable tanks, the alkaline water retaining the gluten; or the latter is removed by allowing it to undergo decomposition, when acetic, butyric, or lactic and other acids are produced. The gluten need not be destroyed, but may be obtained as a by-product;

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for this purpose wheat flour is made with water into a stiff dough; this is set aside for 2 hours, and then placed upon a fine wire sieve, where it is kneaded under a thin stream of water until the latter no longer becomes milky; nearly the whole of the gluten will remain upon the sieve. After sufficient washing with pure water, the starch is drained in boxes, cut into cubical blocks, and dried in properly-constructed drying chambers.

Mucilage of starch, when heated to about 160° C. (320° F.), or when boiled with very dilute sulphuric acid, or when digested with diastase at about 70° C. (158° F.), is converted, according to Musculus (1860), first into *maltose*, $C^{12}H^{22}O^{11}$, which is probably a compound of *dextrin*, $C^6H^{10}O^5$, and *dextrose*, $C^6H^{12}O^6$, the former passing finally likewise into glucose. Iodine imparts to starch in the presence of water, and to starch-mucilage, a blue color which disappears on the application of heat, but reappears on cooling. Bromine colors the starch brown-yellow. Fuming nitric acid transforms starch into *xyloidin*, $C^6H^9(NO^2)O^5$, which is a white, tasteless powder, insoluble in alcohol, but softening in boiling water. A filtered solution of starch in water yields with tannin a flocculent precipitate which is soluble in boiling water. When incinerated, starch should leave not over 1 per cent. of ash.

The exports of Wheat from India to Europe last year exceeded 1,397,000 tons, an increase on the shipments of the previous twelve months of 725,000 tons, or 110 per cent., and they were larger than the previous largest shipments in any year, that of 1886, by 265,000 tons, or 23·4 per cent. In the past seven calendar years the exports from the three great shipping ports have been as under:—

Years.	From Bombay.	From Kurrachee.	From Calcutta.	Total Tons.
1891	665,543	512,632	219,221	1,397,466
1890	272,644	334,042	65,439	672,125
1889	305,044	341,137	77,637	723,818
1888	483,035	149,277	148,776	781,088
1887	462,428	32,977	229,012	724,417
1886	617,834	186,352	328,558	1,132,744
1885	542,562	307,844	212,277	1,062,683

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The shipments from Bombay show an increase on the preceding year of 144·5 per cent., those from Kurrachee of 53·6, and from Calcutta of 236·9 per cent. The share of these three ports in the trade in the past two years and in 1886 has been as under:—

	1891. Per cent.	1890. Per cent.	1886. Per cent.
Bombay... ...	47·6	40·6	54·5
Kurrachee ...	36·7	49·7	15·7
Calcutta ...	15·7	9·7	29·8

Three years ago Kurrachee took the lead, and in the following year she increased it, thanks to the large crops in the Punjab, from whence she draws the bulk of her supplies. Last year the crop in the Punjab, the largest wheat-producing province in India, was a bumper one, and as the demand from Europe was more than usual, the exports from the chief port of Sind were far in excess of any previous year, and exceeded half a million tons. But she was, nevertheless, unable to maintain her supremacy. With full crops in the Central Provinces and in the North-West Provinces and Oudh, but under the average in this Presidency, Bombay once again took the lead with a total of close on 666,000 tons, or about 30 per cent. more than from Kurrachee and a 11 per cent. larger share in the total exports from the country. To the larger crop in the N.-W. Provinces and Oudh the increased shipments from Calcutta are due, for in Bengal the crop was slightly under the mean; but her future position, as an exporter of Wheat, is bound to weaken, rather than improve, on that held by the ports on the Western side. In the past seven years on an average 51 per cent. of the shipments have been despatched to Great Britain and 49 to the Continent, but last year only 41 per cent. went to U. K. Ports and 59 to the rest of Europe. Of the shipments from Bombay in 1891, the Continent received 63 per cent., from Kurrachee nearly as much—*viz.*, 61 per cent.,—but from Calcutta only 41 per cent. went. The crop now growing promises well in the Punjab and North-West Provinces, in both of which the area was recently estimated

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as larger than last year: in the former at about one, and in the latter at four per cent. more, or about 10¾ and 11 per cent., respectively, in excess of the normal area. In the Central Provinces and in this Presidency, the estimates, when completed, are expected to fall short of both last year and the average, owing to the season being unfavourable for the later sowings, but in Berar the area is returned at over two per cent. more than last year's. More rain is wanted, especially in the Central Provinces, Berar, and in parts of our own Presidency, and unless it soon falls the outturn will be still further reduced. A large business in Punjab Wheat was done a few months ago for April-May delivery in Bombay, but owing to the dealers in the Central Provinces holding out for new terms of sale in the local market, very little of the grain of those provinces has so far been contracted for. They have only recently given way, and agreed to sell on the old terms, too late, however, for the market has slipped back and prices have dropped considerably from their former high level.

HORDEUM HEXASTICHUM, *Linn.*

Fig.—*Duthie, Fodder Grasses of N. India, Pl. F, f.* 32. Barley (*Eng.*), Orge (*Fr.*).

Hab.—Western temperate Asia. Cultivated in the N.-W. Provinces of India.

Vernacular.—Jav (*Hind.*), Jab (*Beng.*), Java (*Mar., Tel.*).

History Uses, &c.—Indra in the *Rig-Veda* is called *durah yavasya,* "the giver of the barley." At many Hindu ceremonies, such as the birth of a child, marriages, funerals, and in various sacrifices, barley is used. In the *Atharva-Veda* the rice and barley offered to the dead are prayed to to be propitious to them, and in the same *Veda* rice and barley are invoked for the cure of disease and deliverance from other evils: "*Etau yakshmain vi bádhete; etau mun'ch'ato anhasas.*" Barley is symbolic of wealth and plenty; it is also a phallic emblem; Asvaláyana, in the first book of the *Grihyasutra*, says

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that in Vedic times, the wife when three months gone with child fasted; after her fast, her husband came to her with a pot of sour milk into which he threw two beans and a grain of barley, and whilst she was drinking it, he asked, "What drinkest thou?" She, having drunk three times, replied, "I drink to the birth of a son." Náráyana, in his Commentary on Asvaláyana, states that the two beans and the grain of barley represent the organs of generation. (*De Gubernatis.*)

At the Yava-chaturthi, on the fourth day of the light half of the month Vaisákh, a sort of game is played in which people throw barley-meal over each other. Yava-sura, an intoxicating drink, is made from barley in Northern India. According to Bretschneider, barley is included among the five cereals, which, it is related in Chinese history, were sowed by the Emperor Shen-nung, who reigned about 2700 B.C.; but it is not one of the five sorts of grain which are used at the ceremony of ploughing and sowing as now annually performed by the emperors of China.

Theophrastus was acquainted with several sorts of barley (κριθή), and, among them, with the six-rowed kind or *hexastichon,* which is the species that is represented on the coins struck at Metapontum in Lucania between the 6th and 2nd centuries B.C.

Barley is mentioned in the Bible as a plant of cultivation in Egypt and Syria, and must have been, among the ancient Hebrews, an important article of food, judging from the quantity allowed by Solomon to the servant of Hiram, king of Tyre (B.C. 1015). The tribute of barley paid to King Jotham by the Ammonites (B.C. 741) is also exactly recorded. The ancients were frequently in the practice of removing the hard integuments of barley by roasting it, and using the torrified grain as food. (*Pharmacographia.*)

The Hindus employ barley in the dietary of the sick. It is chiefly used in the form of *saktu* or powder of the parched grain. Gruel prepared from *saktu* is said to be easily digested and to be useful in painful dyspepsia. In Europe, for use in

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medicine and as food for the sick, pearl-barley is always employed; this is the grain deprived of its husk by passing it between horizontal mill-stones, placed so far apart as to rub off the integuments without crushing it. Pearl-barley imported from Europe is obtainable in most Indian bazars. For an account of the economic uses of barley, we would refer the reader to an article by Dr. J. Murray in the *Dict. Econ. Prod. of India* (iv., p. 273).

Description.—The structure of the barley-grain after the paleæ have been removed is similar to that of wheat (see *Triticum*). The paleæ consist chiefly of long fibrous, thick-walled cells, two or four rows deep, constituting a very hard layer. On transverse section, this layer forms a coherent envelope, about 35 mkm. thick; its cells, when examined in longitudinal section, show but a small lumen of peculiar undulated outline from secondary deposits. (*Pharmacographia.*)

Chemical composition.—The following figures representing the average minimum, maximum, and mean composition of 127 samples of barley from different sources are quoted by König:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extract.	Cellulose.	Ash.
Minimum ...	7·23	6·20	1·03	49·11	1·96	·6
Maximum ...	20·88	17·46	4·87	72·20	14·16	6·92
Mean ...	13·77	11·14	2·16	64·93	5·31	2·69

According to Church, the average percentage composition of husked Indian barley is, water 12·5, albuminoids 11·5, starch 70·0, oil 1·3, fibre 2·6, ash 2·1.

Lermer (*Vierteljahresschr. für prakt. Pharm.*, XII. (1863), 4-23) found European barley to have the following percentage composition:—Water 13 to 15, oil 3·0, starch 63·0, cellulose 7·0, dextrin 6·6, nitrogen 2·5, ash 2·4, lactic acid a trace. The protein or albuminous matter consists of different principles, chiefly insoluble in cold water. The soluble portion is partly coagulated on boiling, partly retained in solution. 2·5 per cent. of nitrogen, as above, would answer to about 16 per cent of

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albuminous matters. Their soluble part seems to be deposited in the starch-cells, next to the gluten cells, which latter contain the insoluble portion.

The ash, according to Lermer, contains 29 per cent. of silicic acid, 32·6 of phosphoric acid, 22·7 of potash, and only 3·7 of lime. In the opinion of Salm-Horstmar, fluorine and lithia are indispensable constituents of barley.

The fixed oil of barley, as proved in 1863 by Hanamann, is a compound of glycerine, with either a mixture of palmitic and lauric acids, or less probably with a peculiar fatty acid. Beckmann's *Hordeinic Acid* obtained in 1855 by distilling barley with sulphuric acid is probably lauric acid. Lintner (1868) has shown barley to contain also a little *Cholesterin*.

Lastly, Kühnemann (1875) extracted from barley a crystallized dextrogyrate sugar, and (1876) an amorphous lævogyrate mucilaginous substance, *Sinistrin*; according to that chemist, dextrin is altogether wanting in barley.

Barley when malted loses 7 per cent.; it then contains 10 to 12 per cent. of sugar, produced at the expense of the starch; before malting no sugar is to be found. (*Pharmacographia.*)

Commerce.—The total yield of barley in British India does not exceed 50,000,000 cwts. In 1887-88 the total exports were 29,575 cwts., valued at Rs. 89,776, of which Bombay shipped 18,688 cwts., Bengal 6,873 cwts., and Sind 4,014 cwts., valued at Rs. 58,632, Rs. 20,556, and Rs. 10,588, respectively. The country which imported most largely was Persia, with 10,358 cwts.; following on which were, Arabia with 7,675 cwts., Ceylon with 7,539 cwts., and Aden, the United Kingdom, Zanzibar, and "other countries" with insignificant quantities. (*Dict. Econ. Prod. India*, iv., p. 281.)

The minor food grains (*Kudhánya* or *Kshudar dhánya*) mentioned by Sanskrit medical writers are:—

Sorghum vulgare, *Pers.*—Yávanála (*Sanskrit*), Joár (*Hind., Beng.*), Javári (*Guz.*), Jondhalá (*Mar.*), Cholum (*Tam.*), Talla (*Tel.*), Chavela (*Mal.*).

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This is one of the most important food-crops of India; from it are made bread, porridge, and other food preparations. Church's analysis shows it to have the following percentage composition:—Water 12·5, albuminoids 9·3, starch 72·3, oil 2·0, fibre 2·2, ash 1·7, phosphoric acid 0·85, potash 0·21.

Setaria italica, *Beauv.*—Kangu (*Sanskrit*), Kora (*Hind.*), Kángni (*Beng.*), Káli-kángani (*Mar.*), Bájri (*Guz.*), Tennai (*Tam.*), Korálú (*Tel.*).

The grain is much esteemed as an article of human food in some parts of India. It is eaten in the form of cakes and porridge in the North-West Provinces and Bombay; in Madras it is valued as a material for making pastry, in the Punjab the leaves are used as a pot-herb. Boiled with milk it forms a light and pleasant meal for invalids. Church's analysis shows it to have the following percentage composition:—Water 10·2, albuminoids 10·8, starch 73·4, oil 2·9, fibre 1·5, ash 1·2 (husked).

Panicum miliaceum, *Linn.*—Chína (*Sanskrit*), Chína (*Hind.*), Chína-ghás (*Beng.*), Varagu (*Tam.*), Vorglo (*Tel.*), Varivava (*Mar.*).

This grain is usually made use of in the form of porridge. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 12·6, starch 69·4, oil 3·6, fibre 1·0, ash 1·4 (husked).

Panicum frumentaceum, *Roxb.*—Syámáka (*Sanskrit*), Sawan (*Hind.*), Shyámádhán (*Beng.*), Shamálu (*Tel.*), Kathli, Shamúla (*Mar.*), Savan, Sama (*Guz.*).

This grain is wholesome and nourshing, and is much used for home consumption amongst the poorer classes. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 8·4, starch 72·5, oil 3·0, fibre 2·2, ash 12·9 (unhusked).

Paspalum scrobiculatum, *Linn.*—Kodrava (*Sanskrit*), Koda (*Hind.*), Kodoádhán (*Beng.*), Arugu (*Tel.*), Gora-harik, Gora-kodru (*Mar.*, *Guz.*).

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Cases of poisoning are occasionally met with in India, arising from the consumption of this grain as an article of food. The symptoms are similar to those seen in poisoning by darnel (see *Lolium temulentum*). Kodru-poisoning occasionally ends fatally: thus, in a case reported to the Bombay Chemical Analyser, from Godhra, in 1879-80, four persons, *viz.*, a man and three children, were poisoned by eating bread made from the flour, and one of the children died. This grain appears to be only occasionally poisonous; according to popular belief, there are two varieties of the grain, Gora or "sweet," and Májara or "poisonous."

Church's analysis shows the following percentage composition of the husked grain:—Water 11·7, albuminoids 7·0, starch 77·2, oil 2·1, fibre 0·7, ash 1·3.

Hygrorhiza aristata, *Nees.*—Nivára (*Sanskrit*), Uridhán (*Hind.*, *Beng.*), Deobhát (*Mar.*).

See article on Rice. Church's analysis shows that wild rice, after it has been husked, has the following percentage composition:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6.

Eleusine corocana, *Gärtn.*—Rági (*Sanskrit*), Mandua, Mandal (*Hind.*), Marua (*Beng.*), Koyur (*Tam.*), Ponassa (*Tel.*), Rági (*Can.*), Náchni, Nágli (*Mar.*).

This grain is much used by the poorer classes in Western India, usually in the form of porridge. It is considered to be particularly wholesome and digestible, and a thin gruel made from it is much used mixed with cow's milk for weaning children and as a diet for invalids. In Goa thin biscuits are prepared with the flour, from which a gruel can at once be made.

Church's analysis shows the grain to have the following percentage composition:—Water 13·2, albuminoids 7·3, starch 73·2, oil 1·5, fibre 2·5, ash 2·3, phosphoric acid 0·4.

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Sorghumsac charatum, *Mœnch.* —Devadhánya (*Sanskrit.*), Deodhán (*Hind.*, *Beng.*), Shálu (*Mar.*), Iniphi (*Guz.*).

A food grain of much value. Church's analysis shows it to have the following percentage composition:—Water 12·8, albuminoids 11·8, starch 68·3, oil 3·0, fibre 3·0, ash 1·1, sugar 6 to 18.

Saccharum sara, *Roxb.*—Cháruka (*Sanskrit*), Sarpa, Sara (*Hind*), Sarabij (*Beng.*), Gundra, Sura (*Tam.*, *Tel.*), Sara (*Mar.*).

The seed of this grass appears to be only used in famine times, or by some of the wild tribes who use the stem for making arrows.

The seeds of Coix and Bambusa, which are also classed amongst the *Kshudra-dhánya*, have been already noticed.

Festuca indica (Rheede, xii., 45) is used to resolve phlegmons.

FILICES.

POLYPODIUM VULGARE, *Linn.*

Fig.—*Eng. Bot.*, 1149; *Woodv. Suppl.*, *t.* 271. Common Polypody (*Eng.*), Polypode de chêne (*Fr.*).

Hab.—Persia, Europe. The rhizomes.

Vernacular.—Basfaij (*Ind. Bazars*).

History, Uses, &c.—This fern is the πολυπόδιον of Theophrastus and Dioscorides, both of whom mention its purgative properties. Dioscorides states that it is used to expel bile and phlegm. Pliny (26, 37) says:—" The root of polypadion, known to us as *filicula,* is used medicinally, being fibrous and of a grass-green colour within, about the thickness of the little finger, and covered with cavernous suckers like those on the arms of the polypus. It is of a sweetish taste, and is found growing among

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rocks and under trees. The root is steeped in water, and the juice extracted; sometimes, too, it is cut in small pieces and sprinkled upon cabbage, beet, mallows, or salt meat; or else it is boiled in pap as a gentle aperient for the bowels. It carries off bile and the pituitous humors, but acts injuriously upon the stomach. Dried and powdered and applied to the nostrils, it cauterizes polypus of the nose. It has neither seed nor flower. In Germany there was a myth in ancient times that the plant sprang from the milk of the goddess Freya, and in more recent times the Virgin Mary was credited with its origin. Owing to the sweetness of the rhizome, it is, in some parts of France, called "reglisse" or "liquorice."

The Persians call the plant Tashtiwán and Baspáïk; the latter name in the Arabic form of Basfaij is now current throughout the East as the name of the drug, and is used by Ibn Sina and the Arabian physicians. The Arabian names for the plant are, Azrás-el-kalb "dog's tooth," in allusion to the toothed appearance of the leaves, Kathir-el-rijl "many-footed," and Thákib-el-hajar "penetrating stones." The Mahometan physicians use it as an aperient, deobstruent, and alterative combined with myrobalans and fumitory; they consider that it acts as an expeller of all kinds of peccant humors; for instance, we have seen it prescribed in cataract and amaurosis by Indian hakims. It is not an article of the Hindu Materia Medica.

Description.—The dried rhizome occurs in pieces of various lengths, and of the thickness of a quill. It is flattened, of a yellowish-brown colour externally, green internally, but when old yellowish; the upper surface is studded with tubercles, to some of which a portion of the base of the frond still adheres. The under surface is more or less spinous from the remains of broken radicles. The taste is sweetish, astringent, nauseous, and somewhat acrid; odour ferny. Under the microscope, the rhizome is seen to consist of a delicate cellular structure containing much starch and green granular matter; it is traversed by large bundles of scalariform vessels.

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POLYPODIUM QUERCIFOLIUM, *Spr.*

Fig.—*Rheede, Hort. Mal. xii., t.* 11. Oak-leaved Polypody (*Eng.*).

Hab.—India. Widely distributed throughout the East. The rhizome.

Vernacular.—Báśing, Vándar-báśing, Aśhva-kátri (*Mar.*).

History, Uses, &c.— Báśing (बाशिंग), the Marathi name of this remarkable fern, signifies the crown-like frontlet which the Marathi people tie upon the forehead of the bride and bridegroom at the marriage ceremony. There can be little doubt that the form of the ornament was suggested by the appearance of the plant; its use is of very ancient date, and probably derived from the aboriginal inhabitants of the hilly districts of Western India, where *P. quercifolium* is very abundant. The thick silky rhizome of this fern is found closely adhering to the dead branches of trees, which it envelopes with its large oak-like leaves. Rheede says that the plant is supposed by the natives of Malabar to partake of the properties of whatever tree it grows upon. This notion prevails all over India with regard to this and other parasites (see *Loranthaceæ*), and, as has already been shown, is quite erroneous.

For medicinal purposes those plants which grow upon the *Strychnos Nux-vomica* are preferred. The author of the *Wanaushadi Prakásha* gives the following prescription containing Báśing as the best cure for phthisis:—Take 2 tolás of Kájrabásing, 1 tolá Ooksi flowers (*Calycopteris floribunda*), 2 tolás Chiretta, 2 tolás Ghás-pitpapra (*Rostellularia procumbens*), 2 tolás Ringan-múl (root of *Solanum indicum*), 2 tolás Bál-bel-phal (small immature fruit of *Ægle Marmelos*), 2 tolás Padminimúl (root of *Nelumbium speciosum*), 4 tolás Sonar-wel-múl (root of *Vicoa indica*), two tolás Gokhru-múl (root of *Tribulus terrestris*). These nine drugs are to be powdered and divided into seven parts. For administration each part is to be boiled in 40 tolás of water, sweetened with 2 tolás of

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sugar-candy, and the decoction (kára) boiled down to one-eighth; this is to be taken in the morning, and the marc is to be again treated in the same manner to furnish the nikára (second decoction) or evening dose. The same prescription is recommended in hectic fever from whatever cause, and in dyspepsia and cough; during its use potatoes and indigestible vegetables are to be avoided.

Rheede (xii., 12, 13) has the following remarks upon the medicinal use of *Polypodium taccifolium* in Malabar:—"Succus radicis vermes enecat, bilem sistit et temperat. Folia in pulverem redacta cum melle assumpta secundinas, menses, imo fœtum ipsum fortiter ejiciunt; mulieres ergo cavete vobis."

ADIANTUM VENUSTUM, *Don.*

Fig.—*Hook. Sp. Fil. ii*, 40; *Bedd. Ferns. Brit. Ind. xx.*

Hab.—Himalaya, Afghanistan, Persia. The plant.

Vernacular.—Hansráj, Mobarkha (*Ind. Bazars*).

History, Uses, &c.—Under the name of ἀδίαντον a fern is described by Dioscorides as having leaves serrated at the top like coriander (φυλλάρια ἔχει κοριάνδρω ὅμοια ἐπεσχισμένα επ ἄκορον). This plant was doubtless *Adiantum Capillus Veneris*, *tum*, the same description would apply equally well to *A. venus-* but which has been adopted by the Mahometan physicians of the East as representing the ἀδιαντον of the Greeks. The Western Arabs, however, appear to use *A. Capillus Veneris*, as they call the plant Kuzburat-el-bir or "coriander of the well," indicating a habitat where *A. venustum* is not found. Other Arabic names for the genus *Adiantum* are Shaar-el-jinn "fairies' hair," Shaar-el-jibal "hair of the mountains," Shaar-el-fual "hair of omens," Sák-el-aswad "black stem," Nasif-el-aswad "black veil," &c. Ibn Sina and other medical writes describe the drug under the name of Barsiawashán, which is the Arabian form of the Persian name Parsiawashán. It is considered to be deobstruent and resolvent, useful for clearing the *primæ viæ* of bile, adust bile, and phlegmatic humors; also pectoral,

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expectorant, diuretic, emmenagogue, and alexipharmic. Used as a plaster it is considered to be discutient, and is applied to chronic tumours of various kinds. The author of the *Burhán* states that the ashes of the plant mixed with olive oil and vinegar are used to make the hair grow upon the bald patches produced by ringworm of the scalp. Theophrastus (*H. P.*, vii., 13) mentions two kinds of *Adiantum*, "white" and "black," used in making hair oil. Greek synonyms for the plant were *politrichon*, *calitrichon*, *trichomanes*, and *ebinotrichon*.

In France a syrup of Maiden-hair is much used as a pectoral; the officinal plant is *A. pedatum*, Linn., or Capillaire du Canada, but *A. trapeziforme*, Linn., Capillaire du Mexique, is allowed as a substitute.

Description.—Fronds 3 to 4 times pinnate. Rachis slender, polished, naked; segments rigid, prominently veined and toothed, upper edge rounded, lower cuneate into the petiole; *sori* one to three, large, roundish, placed in a distinct hollow on the upper edge.

Commerce.—The Maiden-hair of commerce consists solely of *A. venustum*, imported from Persia in large bales which contain a number of small bundles, five or six of which weigh one pound. Value, 3 annas per lb. Other species of *Adiantum* are used locally to a small extent.

ASPLENIUM PARASITICUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii., t.* 17.

Vernacular.—Kári-béli-pánna-maravara (*Mal.*), Mahá-pána (*Mar.*), Káli-pándan (*Goa*).

ASPLENIUM FALCATUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii., t.* 18.

Hab.—India. The rhizomes.

Vernacular.—Nela-pánna-maravara (*Mal.*), Pána (*Mar.*), Pándan (*Goa*).

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History, Uses, &c.—The medicinal use of these ferns is due to the Portuguese, who, on their settling in India, adopted them as substitutes for *Asplenium* of Europe.

A fern called ἄσπληνον or ἄσπληνος πόα was supposed by the ancients to have the property of reducing the size of the spleen; it was also known as σκολοπένδριον "centipede plant," from a fancied resemblance of its fronds to that reptile, and ἡμιόνιον "mule plant," because mules were reputed to be fond of feeding upon it. Dioscorides mentions the use of a decoction of the plant in vinegar for enlargement of the spleen, and also the local application of a plaster made of the leaves steeped in wine. It was also considered to be of use in incontinence of urine, calculus, and jaundice. Women were not allowed to use it, as it was supposed to cause sterility. This plant is generally identified with the *Asplenium Ceterach* of Linneus, "Spleen-wort" or "Milt waste"; others have supposed it to be *A. hemionitis*, Linn., "Mules' fern," or *A. Scolopendrium*, Linn., "Hart's tongue."

Mahometan physicians, under the name of Iskúlúkandriún, give a translation of what Dioscorides says concerning this drug, with a few unimportant additions; practically they appear to know nothing about it, and we have never known any drug to be offered under this name in the bazars. Haji Zein states that it is called Hashishat-el-tihál "Spleen-wort" in Arabic, and in Egypt Kaf-el-nasar "Eagle's clan."

The Indian substitute is used in Goa as an alterative in cases of prolonged malarial fever, usually in combination with Oldenlandia or Andrographis, and the use of the drug has spread to Malabar through the Goan Brahmins who have settled there.

Description.—The part used medicinally is the rhizome, to which are attached the bases of the fronds and numerous radicles, all of a black colour. The rhizome is about as thick as the finger; when broken across it is seen to consist of a parenchyma in which are several bundles of vessels of a lighter colour. These can be separated from the canals in which they are situated without much trouble when the rhizome is fresh.

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Under the microscope, the cell-walls of the parenchyma appear of a dark-brown colour, and the vascular bundles are seen to consist of large scalariform vessels. It has an astringent and slightly bitter taste.

Actinopteris dichotoma, *Bedd. Vern.*—Mor-pankhi, Mayuraka. A fern which grows in the Nilgiri and Himalaya Mountains, and upon rocks and old walls in the Deccan, but is rare in the plains of India; it is used as a styptic. "*Actinopteris* is a genus of polypodiaceous fern of the section Asplenieæ, and consists of curious little plants like miniature fan palms. The technical peculiarities of the genus among the Asplenieæ consist in the simple distinct indusia, free veins, and linear-elongate sori, which are marginal on the contracted rachiform segments of the small flabelliform fronds." (*T. Moore in "Treasury of Botany."*) Atkinson states that this fern is used as an anthelmintic.

LICHENES.

PARMELIA KAMTSCHADALIS, *Esch.*

Hab.—Himalaya, Persia.

PARMELIA PERLATA, *Esch.*

Fig—*Eng. Bot.*, 341.

Hab.—India, Europe, Africa. The plant.

Vernacular.—Charéla, Charcharéla, Pathar-ke-phúl, Silá-bák (*Hind.*), Motha-dagada-phúl, Bárik-dagada-phúl (*Mar.*), Ghabilo, Chadila (*Guz.*), Kalpasi, Kalapu (*Tam.*), Ratipanché (*Tel.*).

History, Uses, &c.—Two lichens are found in all Indian bazars, which are known as the greater and lesser "stone-flowers" in the vernaculars, and in Sanskrit as Silá-valká or "rock-bark." Similar plants were known to the Greeks as βρύον and σφάγνος, and to the Romans as Muscus. Dioscorides (i., 22) notices their medicinal properties, also Pliny (xii., 61). The Arabs call them Ushnah, a name derived from the

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Persian, and Hazáz-el-sakhar "rock-scab." Leith says:—"It is a thing that spreads itself upon the trees called *Balút* and *Sanúbar* (oak and pine) as though it were pared off from a root (كانه مقشور من عرق); and it is sweet in odour, and white." (*Kámús.*) In Persia these lichens are known as Ushnah and Dowálah. The author of the *Makhzan-el-Adwiya* states that Ushnah grows upon the oak, cypress, and other trees; that which is whitest should be preferred; it should have an agreeable odour. He describes it as astringent, resolvent, and aperient, and says that the decoction is used as a tonic and alterative; when burnt, the smoke relieves headache, the powder is a good cephalic snuff. Externally the drug has emollient and astringent properties, and may be used in a bath or as a poultice, &c. The dry powder is applied to wounds and sores to promote granulation. Honigberger mentions the use of the drug at Lahore in disorders of the stomach, dyspepsia, vomiting, pain in the liver or womb, induration of the uterus, amenorrhœa, calculi, and nocturnal spermatic discharges.

Ainslie (ii., 170) says: "*Kull-pashie* is the Tamool name given to a dried pale-coloured rock moss, which the Vytians suppose to possess a peculiar cooling quality, and prepare with it a liniment for the head."

The use of these lichens in the form of a poultice, placed over the renal and lumbar regions to produce diuresis, is noticed in the *Pharmacopœia of India.*

FUNGI.

MYLITTA LAPIDESCENS, *Horan.*

Fig.—*Trans. Linn. Soc., vol. xxiii., t.* 9, p. 97.

Hab.—India and China.

Vernacular.—Carom-pallagum (*Tam.*), Luy-wan (*China*).

History, Uses, &c.—This curious underground fungus is supposed to be allied to the truffles, and is used in Southern

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India as medicine and food. In 1860 Dr. E. J. Waring forwarded to Mr. Hanbury some specimens of these tuberiform productions, and they were examined by Mr. M. J. Berkeley and Mr. Currey. These specimens had been dug out from the chalk-beds in the mountains between Travancore and Tinnevelly, and the hill-people were in the habit of bringing them into Trevandrum for sale. They are much esteemed by native doctors for various complaints, and they are regarded as diuretic. The Tamil name signifies Black Pallagum, Pallagum meaning a medicinal substance. The fungus frequently appears on the Nilgiris, and the Badagas, Karumbars, and other hill-tribes call it "God's bread" or "Little man's bread," and use it for food. In 1889 the Peziza was very plentiful in the Government Cinchona Plantations at Naduvatam, and the specimens were found over a wide area about one foot beneath the surface of the ground. Planters on other parts of the hills have noticed their periodical occurrence in their estates, and the coolies always collect and cook them for their meals.

Description.—These fungoid bodies are like small tubers having a black, finely-wrinkled surface, and the inside is white and marked with veins, and a microscopic section shows the division of the tissue into *areolæ* similar to that exhibited by hypogæous fungi. In a fresh state they have a waxy consistence, but when dry they are hard and horny. Some fresh slices immersed in glycerine for several weeks showed no crystalline or crystalloid formations, and starch was entirely absent.

Chemical composition.—The dried Peziza yielded 1 per cent. of carbonated ash. Boiled with dilute hydrochloric acid a solution was formed, reducing Fehling's test and inactive towards polarised light. Boiled with soda a large quantity of pectinous matter was dissolved.

BOLETUS CROCATUS, *Batsch.*

Hab.—India, on the Jack-tree (*Artocarpus integrifolia*, Linn.).

Vernacular.—Phansámba (*Bazars*), Phanas-alombé (*Mar*).

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History, Uses, &c.—The only notice of this fungus, which we have met with, occurs in Rumphius (*Hort. Amb.*, i., 25), where he says:—"In Malabara ac Zeylana ex eodem quoque succo circa radices colligitur et concrescit in terra massa, seu tuber Portugallis *Isca de Jaca* (tinder of the Jack-tree) dictum, quod molle est et intus flavescit, quod natio ista pro experto habet medicamento contra diarrhœam, ad paucas vero tantum colligitur arbores, atque inde venale in alias quoque transfertur regiones." It appears to be probable that the medicinal use of this fungus was introduced into the East by the Portuguese, who adopted it as a substitute for the *Boletus fomentarius* of Linneus, the *Agaricus Chirurgorum* or "surgeon's agaric" of the old European Pharmacopœias, which the Portuguese call Isca de ferir "wound tinder," and the French Agaric de chêne or Polypore ongulé. It is the Spunk or Touchwood of the English.

In Western India the fungus is ground to a paste with water and applied to the gums in cases of excessive salivation. It is also applied to the mouths of children suffering from aphthæ, and is given internally in diarrhœa and dysentery.

Description.—In form this fungus closely resembles the European Boletus above referred to, and resembles the hoof of a horse. Internally it is of a rich orange-brown colour when fresh, and has a sweetish, styptic taste, but when long kept it turns to a dull brown colour. The fungus consists of a number of laminæ upon the under surface of which the hymenium is situated.

Chemical composition.—A proximate analysis yielded :—

Ether extract	·78
Alcoholic extract	1·60
Aqueous extract	4·10
Alkaline extract	21·34
Crude fibre	53·98
Ash	4·30
Moisture	13·90
	100·00

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The ether and alcoholic extracts consisted of red-coloured resins, but no fatty matter. The aqueous extract contained 2·42 per cent. of an organic acid not related to tannin in its reaction with ferric chloride and gelatine. Solution of soda removed an acid resin having some of the properties of polyporic acid.

POLYPORUS OFFICINALIS, *Fries.*

Fig.—*Guibourt, Hist. Nat. ii.*, 45; *Pereira, Mat. Med. ii.*, Pt. 1, p. 54. Larch Agaric (*Eng.*), Polypore du Mélèze, Agaric blanc (*Fr.*).

Hab.—Southern Europe, Asia Minor. On the Larch. The fungus.

Vernacular.—Ghárikún (*Indian Bazars*).

History, Uses, &c.—The use of this fungus in medicine is of very ancient date. Dioscorides (iii., 1) describes ἀγαρικόν as male and female, the female being the best and having internally a comb-like structure, whilst the male is convolute, round and compact (συμφυες); both have the same taste, at first sweet, afterwards bitter. He states that it grows in Sarmatia, Galatia in Asia, and Cilicia, and that some suppose it to be a root and others a fungus. It is astringent, hot, and purgative, and is also given in fever, jaundice, nephritis, uterine obstructions, phthisis, dyspepsia, hæmorrhage, and pains in the joints; it is alexipharmic. Pliny (25, 57) says: "Agaric is found growing in the form of a fungus of a white colour, upon the trees in the vicinity of the Bosporus. It is administered in doses of four oboli, beaten up in two cyathi of oxymel. The kind that grows in Galatia is generally looked upon as not so efficacious. The male* agaric is firmer than the other, and more bitter; it is productive, too, of headache. The female plant is of a looser texture; it has a sweet taste at first, which speedily changes into a bitter flavour."

* This distinction into male and female is no longer recognized, though it continued to be so till within the last century. (*Bostock.*)

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Pereira states that the drug appears in the modern Greek Pharmacopœia under the name of ἀγαρικόν τὸ λευκον with the Turkish synonym of κατρὰν μανταρι.

Ibn Sina insists upon the great efficacy of agaric (غاريقون) as an alexipharmic. He and other Mahometan physicians closely follow the Greeks in their description of its medicinal properties; they consider that it removes all kinds of visceral obstructions and expels diseased humors; the female kind should be used after it has been rubbed through a hair-sieve and all black particles removed. The use of agaric in phthisis is of ancient date; it was revived by De Haen, Barbut, and others in the present century, and subsequently decried by Andral (*Phil. Trans.*, Vols. 48 and 49). The active principle, agaricin, has recently been recommended in doses of $\frac{1}{12}$ to $\frac{1}{6}$ of a grain as an astringent to check night-sweating and diarrhœa, to diminish bronchial secretion, and to dry up the milk after weaning.

Description.—Pileus corky-fleshy, ungulate, zoned, smooth. Pores yellowish. Berkeley describes the hymenium as concrete with the substance of the pileus, consisting of subrotund spores with their simple dissepiments. The drug is decorticated, dried, and bleached, and occurs in white, friable pieces, from the size of the fist to that of a child's head, which are more or less ungulate or of the shape of half a cone, with a feeble fungous odour and bitter acrid taste. The fungus, when met with in its natural state, has an external yellowish or reddish-grey coat.

Chemical composition.—White Agaric has been analysed by Bouillon-La-Grange, by Bucholz, by Braconnot, and by Bley. The constituents, according to Bley, are: resin, 33·1; extractive, 2; gum and bitter extractive, 8·3; vegetable albumen, 0·7; wax, 0·2; fungic acids, 0·13; boletic acid, 0·06; tartaric and phosphoric acids, 1·354; potash, 0·329; lime, 0·16; ammonia and sulphur, traces.

The active principle of Agaric has usually been said to reside in the resin, but a white amorphous bitter powder (laricin) has

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been separated from it, the formula of which, according to Will, is $C^{14}H^{12}O^{4}$. Martius considers this to be the active principle. Fleury (*J. Pharm. Chim*, (4) XXI., 279 to 284) gives the following result of an examination of the drug:—Five hundred and eighty grams of the powdered fungus, not previously dried, were exhausted successively with ether, alcohol, cold water, boiling water, water acidulated with hydrochloric acid, and water rendered alkaline with potash, and the resulting solutions were examined:—

1. The ether extracts a resin, and a body to which the name of Agaric acid is given. The examination of several salts of this acid yielded results so discordant that no definite formula could be obtained, but the nearest approaches to accuracy lead to the supposition that its formula may be $C^{24}H^{44}O^{7}$. Efforts made to determine the basicity of the acid were unsuccessful. It is shown that the addition of the elements of water to the resin represents the composition of the agaric acid. After heating with very dilute sulphuric acid, a substance is yielded which reduces the cupro-potassic liquor. The agaric acid amounts to about one-fifth of the weight of the fungus.

2. The alcoholic solution has a very red colour, due apparently to the air, and on evaporation yields a residue of the consistence of hard wax, from which ether dissolves a resinous body soluble in alkaline liquids; its reaction is acid, it is not crystallizable, and it contains 1·5 per cent. of nitrogen. It combines with metallic oxides. The remainder behaves like a resin; it is reddish, nitrogenized, fusible below 100°, forms viscous solutions with alkalies, and gelatinous precipitates with other bases.

3. Cold water yields a red solution, which on concentration deposits calcic and possibly also magnesic oxalate in microscopic crystals, while the solution contains a brown resinous nitrogenous body, considered to be identical with Boudier's viscosin.

4. Boiling water extracts a small quantity of a nitrogenous substance.

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5. Water acidulated with hydrochloric acid (2 per cent.) yields a yellowish solution containing lime, iron, magnesia, and oxalic, phosphoric and malic acids.

6. Water containing 2 per cent. of potash yielded a solution, which, on treatment with hydrochloric acid, deposited a flocculent substance unacted upon by acetic or phosphoric acids, and containing 3·12 per cent. of nitrogen.

The remainder, after this treatment, is a whitish flocculent substance; on drying at 100° it blackens and coheres, yet its microscope appearance does not differ from the original aspect of the fungus. It contains 1·21 per cent. of nitrogen, and affords on calcination 2 per cent. of ash containing lime, iron, magnesia (chiefly), potash, and sulphuric and phosphoric acids. The body possesses all the properties of fungin.

The following is the tabulated result of the analysis:—

Water	9·200
1. Resin and agaric acid	60·584
2 Another resin with magnesia sulphate ...	7·282
3. Resinous body with lime and magnesia ...	2·514
4. Nitrogenous substance with salts	1·900
5. Oxalate, malate, and phosphate of calcium, iron, &c.	1·058
6. Nitrogenous substance soluble in potash ...	7·776
Fungin	9·686
	100·000

Schmieder has found that this fungus contains from 4 to 6 per cent. of a fat which is not a glyceride. He obtained from it a crystalline substance having a composition represented by the formula $C^{10}H^{16}O$, which he terms "agaricol." The liquid portion of the fat yields no glycerine on saponification, but cetyl-alcohol and another alcohol together with two hydrocarbons, while the fat acid with which the alcohols are naturally combined appears to resemble ricinic acid (*Rep. of "Naturforscher and Aerzte" Meeting at Berlin*, 1886).

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ALGÆ.

GELIDIUM CARTILAGINEUM, *Gaill.*

GELIDIUM CORNEUM, *Lam.*

Vernacular.—Chini-ghás (*Ind. Bazars*).

History, Uses, &c.—This substance, called Yang-tsai by the Chinese, and known in Europe as Mousse de Chine, Agar-agar, Thao, or Japanese Isinglass, is prepared from the two species of Gelidium placed at the head of this article, and also probably from *Sphærococcus compressus*, Ag., and *Gloiopeltis tenax*, I. Ag. Hanbury (*Pharm. Journ.* (II.), Vol. I., p. 508) gives the following account of it:—"Under the incorrect name of *Japanese isinglass*, there has been lately imported into London from Japan, a quantity of a substance having the form of compressed, irregularly four-sided sticks, apparently composed of shrivelled, semi-transparent, yellowish-white membrane; they are eleven inches long by from 1 to 1½ inches broad, full of cavities, very light (each weighing about 3 drachms), rather flexible but easily broken, and devoid of taste and smell. Treated with cold water, a stick increases greatly in volume, becoming a quadrangular, spongy bar, with somewhat concave sides 1½ inches wide. Though not soluble in cold water to any important extent, the substance dissolves for the most part when boiled for some time, and the solution, even though dilute, gelatinizes upon cooling. The substance under notice is used by Europeans in China as a substitute for true isinglass, for which many of its properties render it highly efficient. That which is perhaps most distinctive is its power of combining with a very large proportion of water to form a jelly. This property is due to the principle named by M. Payen *Gélose*, of which the Japanese sea-weed product mainly consists. The jelly formed by boiling this sea-weed product or crude Gélose in water, and allowing the solution to cool, requires a high temperature for fusion, differing in this respect

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from a jelly made of isinglass, which readily fuses and dissolves in warm water.

This substance has attracted considerable attention in France. It was exhibited at the Paris Exhibition of 1878 under the name of Thao. The following particulars from the Catalogue may prove interesting. Various trials have been made with it in France since 1874, especially by MM. D. Gantillon & Co. at Lyons, and the Industrial Society at Rouen. The thao is prepared for use in the following way:—After having been soaked in cold water for about twelve hours, it is boiled for a quarter of an hour, during which it absorbs about 100 times its weight of water. If allowed to cool it becomes a jelly, but if passed through a sieve and stirred until cold, it remains fluid, and in this state is more easily employed than when hot. The yellowish matter which some specimens contain can be removed by boiling for some time, when it forms an insoluble scum, which appears to consist of very thin fibres, and which remain attached to the sides of the vessel.

A singular property, and one which perhaps might be turned to valuable account, is, that thao jelly does not decompose solution of permanganate of potash even when left in contact with it for twenty-four hours.

According to M. Heilmann, of Rouen, thao produces, in the proportion of 1 part to 100 of water, a dressing, which is supple and strong, and which gives substance rather than stiffness to calico, while dextrine, like starch, makes the tissue drier and harder, and gives less facing to the thread. The addition of glycerine gives a dressing still more flexible and soft, and, while rendering the tissues less stiff, it communicates more body to them.

The addition of talc gives still greater smoothness. Once dissolved, according to M. Gantillon, thao will mix while hot with any gum, starch, dextrine or gelatine. The principal advantage of thao in dressing silk fabrics is that while preserving their suppleness it gives them greater glossiness and makes

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them soft to the touch. The mixture of thao with gum tragacanth is said to be the best method of using it. Thao should, however, be used alone for materials which it is not necessary should be stiffened. As thao is only soluble at a high temperature, a moist atmosphere, fog, or even rain does not affect the material dressed with it.

It combines well with sulphate of copper and the chlorides of aniline and potassium, and can be used in double dyeing.

It also answers well for sizing paper, &c. The only obstacle to its extensive use is its high price. There is, however, no reason why a similar substance should not be made from our common native sea-weeds, of which *Gelideum corneum* and *Gracilaria confervoides* approach omst nearly in character the algæ from which thao is made. Gélose, of which thao consists, differs from the Carrageenin obtained from *Chondrus crispus* in its power of combining with a very large quantity of water to form a jelly; it yields ten times as much jelly as an equal weight of isinglass. For purposes of food, thao jelly is not quite so pleasant as animal jelly, as it does not melt in the mouth; it also contains no nitrogen. A great advantage which it possesses is, that it is but little prone to undergo change, so much so that the jelly is sometimes imported from Singapore, under the name of *sea-weed jelly*, sweetened, flavoured, and ready for use, and may in this state be kept for years without deterioration. Of late it has been much used for the purpose of Bacteria culture, especially in warm climates.

Chemical composition.—According to Payen, Gélose in a pure state constitutes an immediate peculiar principle, insoluble in alkaline solutions of soda, potash, and ammonia, as well as in water, alcohol, ether, and dilute acids. One of its distinctive characters, which is quite peculiar, is that of dissolving slowly in a very small quantity of concentrated sulphuric or hydrochloric acid, which it colours brown, forming with one or other of them a brown compound, which gradually solidifies, and which resists washing in cold or hot water, and even in caustic

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alkaline solutions. This new immediate principle cannot be confounded with any other. The ultimate analysis of Gélose presents the following results:—Carbon 42·77, Hydrogen 5·775, Oxygen 51·445. As it has not yet been possible to form with it any definite combination, from which its equivalent weight or rational formula could be deduced, it must for the present be ranked among the immediate principles having oxygen exceeding the proportion necessary to form water with the hydrogen they contain. Gélose differs from animal gelatine in not precipitating tannic acid; from starch jelly, in not being rendered blue by iodine; from gum, by its insolubility in cold water, and its great gelatinising power. From the mucilage of *Chondrus crispus*, named by Pereira Carrageenin, it appears to differ chiefly in its power of combining with a great amount of water to form a jelly, which is not the case with Carrageenin.

GRACILARIA LICHENOIDES, *Grev.*

Fig —*Bentl. and Trim.*, *t.* 306. Ceylon Moss (*Eng.*).

Hab.—Backwaters of Ceylon. The plant.

Vernacular.—Chini-ghás (*Ind. Bazars*), Agar-agar (*Ceylon*).

History, Uses, &c.—Ceylon Moss or Agar-agar has long been used in Southern India and Ceylon as a nutritive, emolient, demulcent and alterative, especially valuable in pectoral affections. It has been described by Rumphius, Gmelin, Turner, Neos, Agardh, and O'Shaughnessy. (Conf. *Pereira's Mat. Med.*, Vol. II., Pt. I., p. 13.) It grows abundantly in the large lake or backwater which extends between Putlam and Calpentyr, and is collected by the natives principally during the south-west monsoon, when it becomes separated by the agitation of the water. The moss is spread on mats and dried in the sun for two or three days, it is then washed several times in fresh water, and again exposed to the sun, which bleaches it. The following directions for using the moss are given in

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the *Bengal Pharmacopœia*, p. 276:—For a decoction, take 2 drachms ground to fine powder, water 1 quart, boil for 20 minutes and strain through muslin. By increasing the proportion of the ground moss to half an ounce, the filtered solution on cooling becomes a firm jelly, which, when flavoured by cinnamon or lemon peel, sugar and a little wine, is an excellent article of light food for sick children and convalescents.

Description.—Ceylon Moss is in whitish or yellowish-white ramifying filaments of several inches in length (when unbleached it is purple). At the base the largest fibres do not exceed in thickness a crowquill; the smallest fibres are about as thick as fine sewing thread. To the naked eye the filaments appear almost cylindrical and filiform; but when examined by a microscope, they appear shrivelled and wrinkled. The branchings are sometimes dichotomous, at other times irregular. The coccidia are inconspicuous when dry, but when moist are readily seen. They are hemispherical, about the size of a poppy seed, and contain a mass of minute oblong, dark-red spores. The consistence of Ceylon moss is cartilaginous. Its flavour that of sea-weed, with a feebly saline taste. (*Pereira's Mat. Med.*, Vol. II., Pt. I., p. 14.)

Microscopic structure.—Frond composed of large oblong cylindrical cells, containing granular endochrome, those of the surface forming moniliform, densely packed filaments. Fructification of two kinds—1*st*, hemispherical coccidia, containing a glomerule of oblong spores on a central placenta, within a pericarp of moniliform densely crowded filaments; 2*nd*, oblong tetraspores imbedded in cells of the surface. (*Endlicher.*)

Chemical composition.—This algal has been examined chemically, in 1834, by O'Shaughnessy; in 1842, by Guibourt; and in 1843, by Wonneberg and Kreysiig, by Bley and by Riegel. O'Shaughnessy found it to consist in 100 parts of vegetable jelly 54·5, starch 15·0, ligneous fibre (cellulose?) 18·0, mucilage 4·0, inorganic salts 7·5.

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König gives the following as representing the percentage composition:—

Water	19·56
Albuminoids	2·53
Nitrogen-free extract	73·60
Ash	4·31

The authors of the *Pharmacographia* state that, "Cold water removes the mucilage, which after due concentration may be precipitated by neutral acetate of lead. This mucilage, when boiled for some time with nitric acid, produces oxalic acid and microscopic crystals of mucic acid, beautifully seen by polarised light, soluble in boiling water and precipitating on cooling. With one part of the drug and 100 parts of boiling water, a thick liquid is obtained, which affords transparent precipitates with neutral acetate of lead or alcohol, in the same way as Carrageen. With 50 parts of water, a transparent tasteless jelly, devoid of viscosity, is produced; in common with the mucilage it furnishes mucic acid if treated with nitric acid. Micro-chemical tests do not manifest albuminous matter in this plant. Some chemists have regarded the jelly extracted by boiling water as identical with pectin, but the fact requires proof. Payen called it Gélose." (See last Article.) Mr. H. G. Greenish has examined the carbohydrates of Ceylon Moss, and found that the gelatinizing constituent—the Gélose of Payen—is a carbohydrate convertible by boiling with dilute acid into Arabinose, and probably indentical with a similar constituent in the Agar-agar. In addition to this body (36·7 per cent.), the drug contains mucilage, starch, metarabin, wood gum, and cellulose. A carbohydrate termed Paramylan, occurring to the extent of 6·5 per cent., is also present. This substance is dissolved out by dilute acid, and differs from Pararabin in being directly convertible into sugar, and then yielding not Arabinose, but a fermentable sugar, probably grape-sugar. (*Archiv. der Pharmacie*, xvii., 241.) The inorganic salts of Ceylon Moss consist, according to O'Shaughnessy, of sulphates, phosphates and chlorides of sodium and calcium, with neither iodide nor bromide. Bley found iron, silica and iodic salt in the ash.

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Commerce.—See last Article. This substance is preferred to Japanese Isinglass by the Hindus, as they suspect the latter substance to be of animal origin. Value, Rs. 12 per cwt.

LAMINARIA SACCHARINA, *Lam.*

Fig.—*Turn. Fuc., t.* 163. Sweet Tangle (*Eng.*).

Hab.—All deep Seas. The plant.

Vernacular.—Galhár-ka-patta (*Hind.*).

History, Uses, &c.—This sea-weed is a regular article of commerce coming through Cashmere to India, and is to be found in most of the bazars of the Punjab and Sind. Cayley (1867) noted its import into Leh from Yarkand, and Honigberger states that in his time the plant was officinal at Lahore and in Cashmere, and that it was stated to be obtained from a salt lake somewhere in Tibet. Murray says that it is supposed to come from the Caspian, and that it is used in Sind in the form of a syrup combined with a decoction of quince seeds for the cure of goitre, scrofula, and syphilitic affections. When dried in the sun it exudes a whitish saccharine substance.

For an interesting note on *Algin,* first isolated by Mr. Stanford from sea-weed, we would refer the reader to the *Jr. Soc. Chem. Industry* for 1885 and 1886.

DIATOMACEÆ.

Husn-i-yusuf is composed of small, hard, white bodies, which, on being magnified, are seen to be the shells of different diatoms. The drug is described in native medical works as very acrid and only to be used externally as a rubefacient. It is said to be found floating in lakes in Cashmere, and would appear to be the same as the Shuka of Sanskrit medical

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writers, which was rubbed in to increase venereal excitement; its use seems to have been much abused, as we find *Shukadoshanimittavyadhayah* (sores caused by Shuka) treated of as a disease by Susruta.

The Madhukosha describes Shuka thus—

शूको जलशूकः। यस्तु विषजंतुर्जलमण्डूकः स शूकः। शूकप्रधानो वात्स्यायनाद्युक्तो योगो लिंगवृद्धिकरः स शूक उच्यते। सटीकनिदानम्।

—*Calcutta Ed.*, p. 298.

END OF THE THIRD VOLUME.

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